the OIL AND GAS JOURNAL

OCTOBER 7, 1957

TIPS ON REFINERY Bottleneck Removal...

16 PAGES OF COMMON PROCESS BOTTLENECKS AND METHODS FOR EFFECTIVE REMOVAL

P. 123

EXCLUSIVE

For the first time . . . **Pentagon Releases Estimates of Future Military Oil Needs** p. 95

How Much Oil Can U.S. Produce?

Latest study sets figure at 9,867,000 bbl. daily p. 104

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the OIL AND GAS JOURNAL Newsletter

Oct. 7, 1957
Tulsa, Okla.

Oil men face a tremendous job in next 10 years:

Capital expenditures world-wide for oil industry will total $130 billion in upcoming decade, Chase Manhattan Bank says. That compares with $63 billion invested in last 10 years.

Need for that much capital will change oil's way of doing business. Earnings won't generate enough capital. Oil-finance managers will be forced into the money market instead of paying for expansions through profits.

Predictions for next 5 years show why: Expected earnings will reach $39.9 billion. Subtract $8 billion for dividends. That leaves $31.9 billion to cover $35.3 billion capital outlay. It's short by $3.4 billion.

This trend may explain Jersey Standard's decision to raise $250 to $300 million this year from sale of stock.

Financial circles regard this as an historic event. It's first time in 30 years giant Jersey Standard has issued new stock. And it's the second largest common stock offering in annals of U. S. finance.

Variety of reasons are given for the step: High cost of money today; unwillingness to increase funded debt; and inability to meet capital needs through earnings.

Jersey plans to spend $1¼ billion this year on capital needs and exploration.

Risks involved in cutting your steel-goods inventories too thin are increasing, especially if you intend it as a long-term policy.

Those who follow steel trends closely give this rundown:

Nearly all industries—along with oil—have chopped their steel buying sharply this year and are reducing inventories. This has put a crimp in steel sales. But even so steel plants have been running at about 85 per cent capacity.

Steel men say auto buying now is picking up and others will be back in the market soon. But they warn if everyone jumps in at same time, a tight market will result. Some may be frozen out.

On the long-term, steel prices will rise again in mid-1958 and possibility is increasing for a steel strike in 1959. It means this may be a good time to start building back inventories especially to hedge the wells or projects you know are coming up.

Two cuts in crude prices which popped up last week apparently represent only local adjustments.

Ohio Oil cut 8 cents a barrel from its postings for Wyoming heavy oils of 26°-gravity and below. Company explained that since December these heavy black oils had increased more than the 25-cent general advance. The adjustment restored their earlier relationship.

Indiana Oil Purchasing cut 10 cents a barrel off postings for Arkansas pools except Cairo and Catesville where reduction was 15 cents. The cuts will make the crudes competitive with other oils moving to the El Dorado refining area.

The oil industry's biggest single customer—the U. S. military—will need less petroleum products in the years ahead (p. 95).

From an exclusive interview with top defense planners, editors of The Oil and Gas Journal got this picture:

Military fuel needs will drop 5 per cent this fiscal year.

Buying will rise sharply next year, but after that will decline gradually by about 1 per cent a year until at least 1962.

Missiles and atomic-powered vessels will cut requirements for oil.

Defense planners now have a new set of figures showing how much oil U. S. can count on in a crisis (p. 104). A special study made for the National Petroleum Council shows:

...Production capacity of oil industry is at a new high: 9,867,000 bbl. daily. Thanks to technological developments this is a gain since 1954 of 1,536,000 bbl. daily.

...Reserves have climbed from 25.2 billion barrels in 1951 to 30.4 billion in 1957. But note this: Ability to produce has increased at faster rate than reserves. It means the industry has become better oil producers than oil explorers.

...New drilling is key to maintaining both productive capacity and reserves. With no new drilling, production would drop 750,000 bbl. daily first year. It will take from 41,000 to 50,000 wells a year just to maintain productive capacity.

Study boils down to this: In an emergency, oil industry must have sufficient steel to drill and carry on maintenance.

Main thought carried away from Fort Worth meeting of Texas Mid-Continent Oil and Gas Association:

Segments of the oil industry must quit fighting among themselves. Disunited industry means slow political doom.

Also: Only chance for a natural-gas bill is for the industry to unite behind Harris bill and fight hard for it.

First shipment of liquid gas should reach Britain in 18 months.

British are setting up a practical study of the economics of moving liquefied natural gas by tanker from Venezuela. If the idea proves practical, it will open a huge market for gas in Europe and other areas remote from gas production and pipelines.

Chief equipment being prepared for the test: A specially insulated, 3,500-ton tanker and refrigerated storage in England.

British are sold on idea's prospects. They say three 30,000-ton tankers making 15 journeys a year could move enough gas to supply half of nation's present needs. Impact of a cheap fuel supply on Britain's industrial economy is obvious.

Prospects of drilling in waters up to 1,500 ft. or deeper look good on basis of experience in California. A revolutionary new technique for drilling from a floating barge is turning the trick.

Operators already have successfully made core-drill tests in West Coast waters 1,500-ft. deep. One hole was drilled to 6,300 ft.

Big advantage: Tremendous savings in offshore drilling costs which are brought almost in line with onshore costs.

Rig rates for offshore work may come down in the Gulf of Mexico within the next few months. Reason: Competition is increasing among offshore drilling contractors for work.

Many contractors fear they're in for price cutting rivaling that which has plagued onshore operators for several years. Two developments are setting the stage for weak prices: Reduced drilling offshore and increase in number of rigs available.

At latest report seven offshore rigs are idle on coast. And some 15 new mobile drilling units are under construction. Offshore completions are 60 per cent ahead of last year, but wildcat drilling has dropped off sharply. At end of September only seven wildcats were drilling off Louisiana. A year ago there were 25.

What's the answer? Both operators and contractors say increased allowables offshore would help. Another federal government lease sale also would spur activity. Neither one of the remedies seem imminent, however.

Richfield has staked another Alaskan wildcat about 2 miles south from its Kenai discovery, the first of any consequence in the territory.

The discovery, 1 Swanson River Unit, has been completed. It flowed 900 bbl. of 33°-gravity oil and 122,000 cu. ft. of gas daily through 1½-in. choke. When put on ¾-in. choke, it flowed 360 bbl. of oil and 50,000 cu. ft. of gas daily at 900 psi. tubing pressure.

Oil hunters will run into "keep out" postings on federal wildlife refuges. New regulations ban all oil and gas leasing except in cases to prevent drainage of government oil by operators on adjacent lands.

Two exceptions to the rule: Limited leasing will be permitted on big-game ranges, mostly in Alaska, and on state-federal cooperative units where drilling won't endanger the range or wildlife.

Free-world oil production declined in July for first time in 5 months, reports just in show. Reason was drop in production by the U. S. and Venezuela. Output in Persian Gulf, except Kuwait, rose.

Nation's biggest unitized water-flood project will emerge if other operators accept Sohio's plan to form a Spraberry unit (p. 98).

Sohio has called in 46 operators representing 75 per cent of acreage involved and offered this plan: Unitize 100 sections of 64,000 acres, start up pilot floodon 9 sections first, then expand it to cover the unit. Expected return $20 for each $1 invested.

Sohio believes 100 sections is all the acreage one operator can administer. But the prospect is this: If the Sohio plan works, other cooperative units will be formed in the sprawling Spraberry area.

French are disappointed more big American oil firms didn't bid on Sahara Desert oil leases (p. 120).

Only four American companies—Cities Service, Newmont Mining, Sinclair, and Phillips—put in bids for the acreage along with the Royal Dutch-Shell Group, British Petroleum Co., and myriad private French interests.

Lack of interest by other American majors was blamed on troubled French political situation, short time allowed to submit bids, and requirement for at least 50 per cent French participation.

Big hunk of available Pembina gas—about 80 per cent—has been signed up by Alberta & Southern Transmission. It'll move over proposed $330-million pipeline from Alberta to California.

Company will start buying when gathering and transmission lines are completed, probably late in 1958.

Westcoast Transmission is planning to loop its $170-million gas pipeline system in a move to double capacity. The project will be in addition to current work costing $70 million which will boost capacity from 400,000 M.c.f. daily to 660,000 M.c.f.

Imports-control officials will try to make the original quotas stick. That's the big lesson from Captain Carson's action last week in denying quota increases for Tidewater, Indiana Standard, and Ohio Standard.

Big question now: Will these importers go along with the voluntary program?

New slants are appearing on strategy independent refiners and operators may take if imports program fails. These groups reportedly will work on Congress to increase tariff for oil when Reciprocal Trade Agreements Act comes up for extension in next session.

Refining notes: Vast Odessa petrochemical complex in West Texas is partially on stream. Odessa Butadiene's new plant has started turning out material for General Tire's nearby copolymer plant. Work is progressing on a styrene plant and refinery (p. 110) ...Texaco's new 20,000-bbl. refinery near Santiago de Cuba is on stream...National Petro-Chemicals plans 75-million-pound polyethylene plant near Houston.

Good Wells Make Good News

October 7, 1957

DOWELL FRACTURING SERVICES are designed to give you good results and quick return on investment. They are offered in all volumes and injection rates, with a wide variety of fracturing fluids and addition agents. Here are some recent outstanding examples of the results obtained from Dowell fracturing services.

- **Ward County, West Texas** (Old Well): Gyp deposits had reduced production from well in waterflood project (Yates formation) to 20 bopd. Monthly workovers in this field, to remove gyp from pumps, were not uncommon. This was increasing production costs. Dowell recommended Sandfrac®, using 5000 gallons lease crude with 10,000 pounds sand and 600 pounds Gypban* to prevent the formation of gyp deposits. Injection down casing averaged 32.8 bpm. *Four months after treatment, production had stabilized at 115 bopd—without requiring a single workover. Treatment cost of $2,717 was recovered during first two weeks after treatment.*

- **Crawford County, Illinois** (New Well): Completion was made by perforating between 1450 and 1518 feet in two zones of the Benoist and one zone of the Aux Vases. Dowell recommended Petrojel* using 9000 gallons thickened crude and 13,500 pounds sand. Treatment was in three, 3000 gallon stages. 52 Buna-N—covered nylon balls were injected during stages to plug, temporarily, zones already fractured. From a show of oil before treatment, well swabbed 10 boph following Petrojel service and was put on pump at 140 bopd. *Treatment costs of $1,343.45 paid out in less than 14 days.*

- **McPherson County, Kansas** (Old Well): Production from perforations in Maquoketa dolomite (3326 to 3356 feet) had declined to 10 bopd. Dowell fractured with Stratafrac®, using 3000 gallons acid-kerosene emulsion and 3250 pounds sand. Injection was down tubing. *Immediately following treatment, the well tested 60 bopd. 330 days after treatment, well was still producing 35 bopd. Total cost of Stratafrac service paid out in less than 60 days.*

- **Major County, Oklahoma** (Old Well): Production from Manning formation through perforations, 6745 to 6835 feet, had decreased to 5 bopd. Operator ordered Riverfrac*, using 150,000 gallons fresh water with 12,000 gallons Dowell "X" Acid and 100,000 pounds sand. Treatment was down 5½-inch casing at 45 bpm average. *After 60 days, well had stabilized at 38 bopd.*

For quick payout and good ultimate recovery, start with the right treatment. Let your Dowell engineer tailor your fracturing treatments to the requirements of your wells. For service call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

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the OIL AND GAS JOURNAL

OCTOBER 7, 1957 • VOLUME 55 • NUMBER 40

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TECHNOLOGY—OPERATION

Refining-Processing

Bottleneck Removal In Refineries 123

By Larry Resen

A 16-page section on how to spot and remove bottlenecks in distillation, heat exchange, pumping, catalytic cracking, and other refining operations. There are 42 separate items, each one covering a typical bottleneck situation and its solution. Each item has a simplified drawing and accompanying text, showing what the problem is and how it can be solved.

Nelson's Refinery Construction Index 143

Ethylene Oxide by the Direct Oxidation Process 150

By Peter W. Sherwood

Part 2 of a two-part series. Twelve variables are important in selecting the operating conditions for making ethylene oxide by the direct oxidation process. The effects of these variables have been determined and are discussed here. Part 1, September 30, 1957 issue, summarizes the growth of this process and points out possible future results.

COST-imating 169

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Refiner's Notebook 177

Pipelining

Compressor Stations Go Modern in a Five-Point Program 144

By M. J. Paul

Five major modernization programs have been undertaken by Natural Gas Pipeline Co. of America in recent years. They are: (1) Remotely controlled blowdown systems; (2) modified closed water-cooling systems; (3) supercharging compressor engines; (4) exhaust tuning of auxiliary engines; and (5) exposure of manifold piping.

Pipeline Patrol: Pipelining Gilsonite 181

By Robert K. Bond

The 72-mile, 6 in. pipeline of American Gilsonite Co. transports 700 tons per day of gilsonite solids in the form of a water slurry. Here are some engineering details of the design and operation of this line.

Drilling-Production

Drilling with Casing and Wire-Line Retractable Bits 141

By J. M. Camp, J. E. Ortloff, and R. H. Blood

Carter Oil Co. field and laboratory tests show that this drilling technique can save up to 25 per cent on a 7,500-ft. well. And with deeper holes, the savings should increase because trip time increases.

How Fractured Limestone Responds to Gas Injection 156

By W. E. Nolan and G. R. Locker

Fractured and vugular limestone will respond to both gas injection and water flooding in improving oil recovery. This conclusion is borne out by results obtained on the Clearfork dolomitic limestone, Fullerton field, Andrews County, Texas.

This Mobile Platform Will Tackle 600-Ft. Water 162

By R. L. LeTourneau

A platform which reportedly makes it possible to drill in water up to 600 ft. deep has been designed and can be built at a reasonable cost, according to the author.

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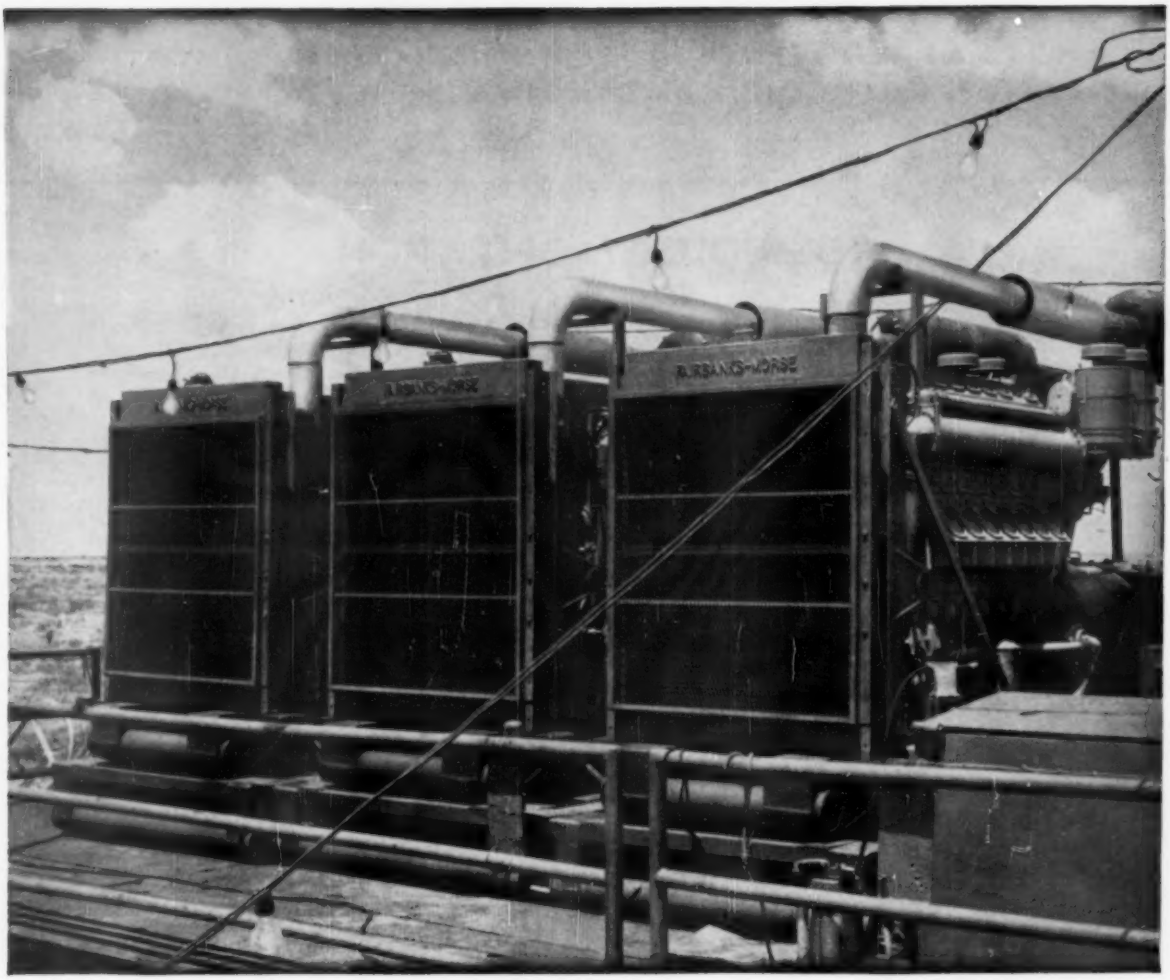

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Speed range?... The 38-F-90 is rated for continuous heavy-duty service from 450 to 1200 RPM. This range is right for any mechanical, hydraulic or electric drive.

Give and take?... The 38-F-90 is a Fairbanks-Morse engine. This means that it will give service and take punishment. Its simplicity and its stamina are the result of its Opposed-Piston two-cycle design and its all-steel welded frame.

This all adds up to why the Fairbanks-Morse 38-F-90 is a *drilling* engine. Fairbanks, Morse & Co., Oil Field Division, Chicago 5, Illinois.

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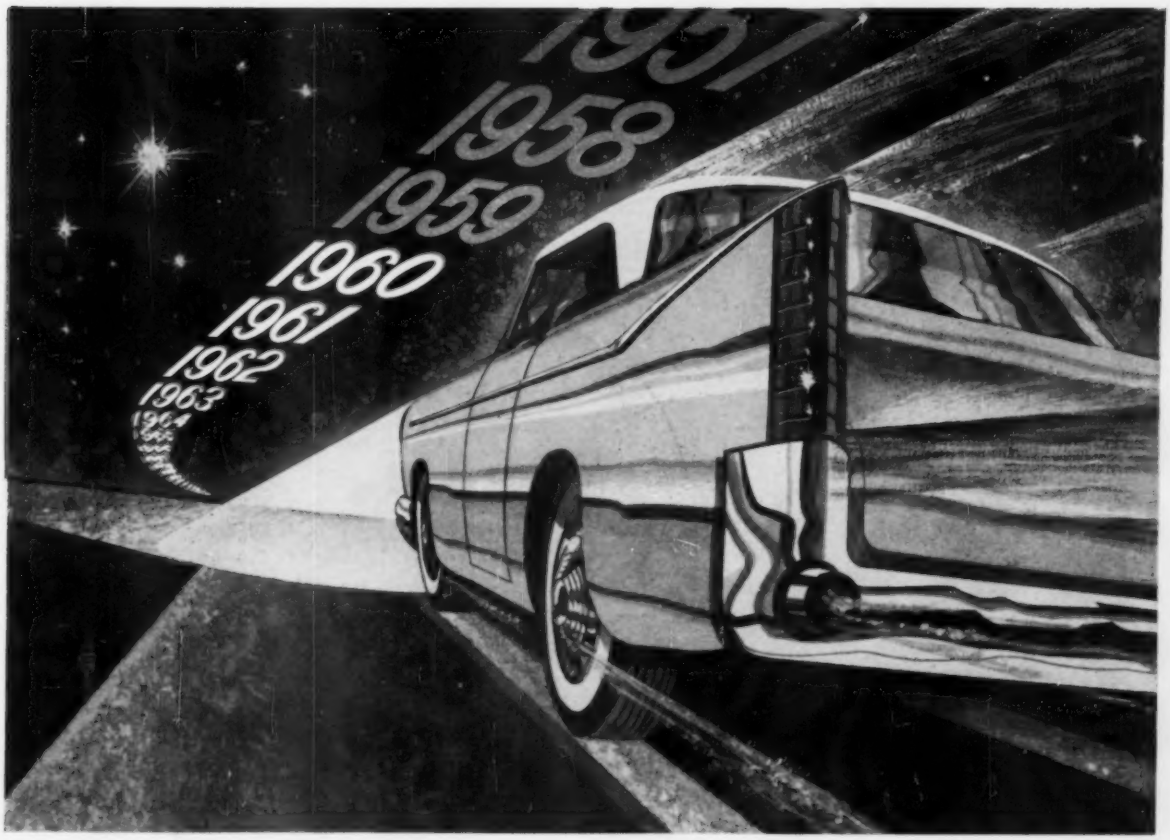

New Du Pont study looks into octane requirements of the future

A new Du Pont study points up the complexity of the problems you may face in planning future refinery processes and operations. Solution of these problems may depend on the answers to two basic questions:

What road octane quality can be expected from possible future gasoline compositions in tomorrow's high-compression-ratio cars?

Which of the gasolines of comparable road octane quality will be most economical to make?

Recently, some answers to the first question were found by Du Pont researchers investigating gasoline blends suitable for tomorrow's cars. More than 5,000 road octane numbers were obtained during the Du Pont study.

High-compression-ratio cars used in test

Twenty-eight representative samples from the five major refining processes in 73 different fuel blends—at 10 pounds RVP and leaded to 3 ml. per gallon—were road-rated in a fleet of cars whose engines were modified to 11.1 and 12.1 compression ratios.

With the data provided, cost comparisons can be made between blends of comparable octane quality to answer the question of maximum refining economy.

Write for free copy

Several conclusions were reached on the basis of information gathered during the Du Pont study. The complete results are now available in a paper entitled, "Road Octane Numbers of Tomorrow's Gasolines in Tomorrow's Cars." Write us if you would like a copy.

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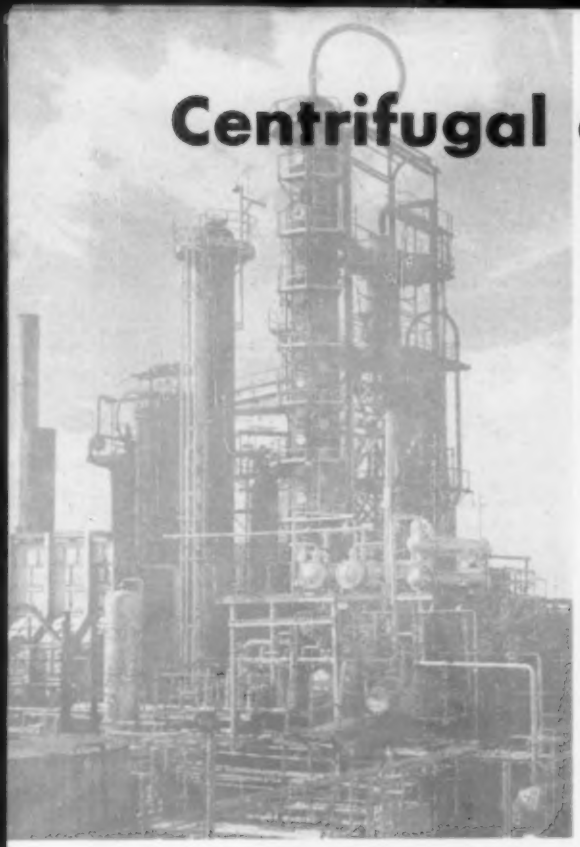
Centrifugal or Reciprocating?



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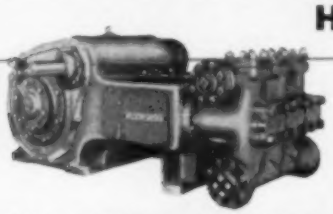
As a manufacturer of both centrifugal and reciprocating types (including both power-driven and direct-acting steam-driven), you can be sure our unbiased recommendation will be the type best suited for your specific applications.

Here are Four Popular Types



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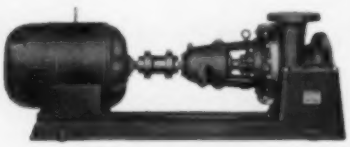
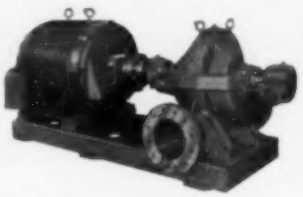


ES CENTRIFUGAL PROCESS PUMPS . . . Single or two-stage heavy-duty type for elevated temperature applications to 900°F., employing vertically split case and single stuffing box for conventional packing or mechanical seal of your choice. End suction, as illustrated, is standard construction—can also be furnished with top suction when preferred. Twenty sizes provide capacities from 15 to 2,000 GPM, 50 to 1100-ft. head, 2 to 250 HP.



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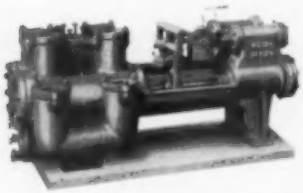

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Odessa, Texas

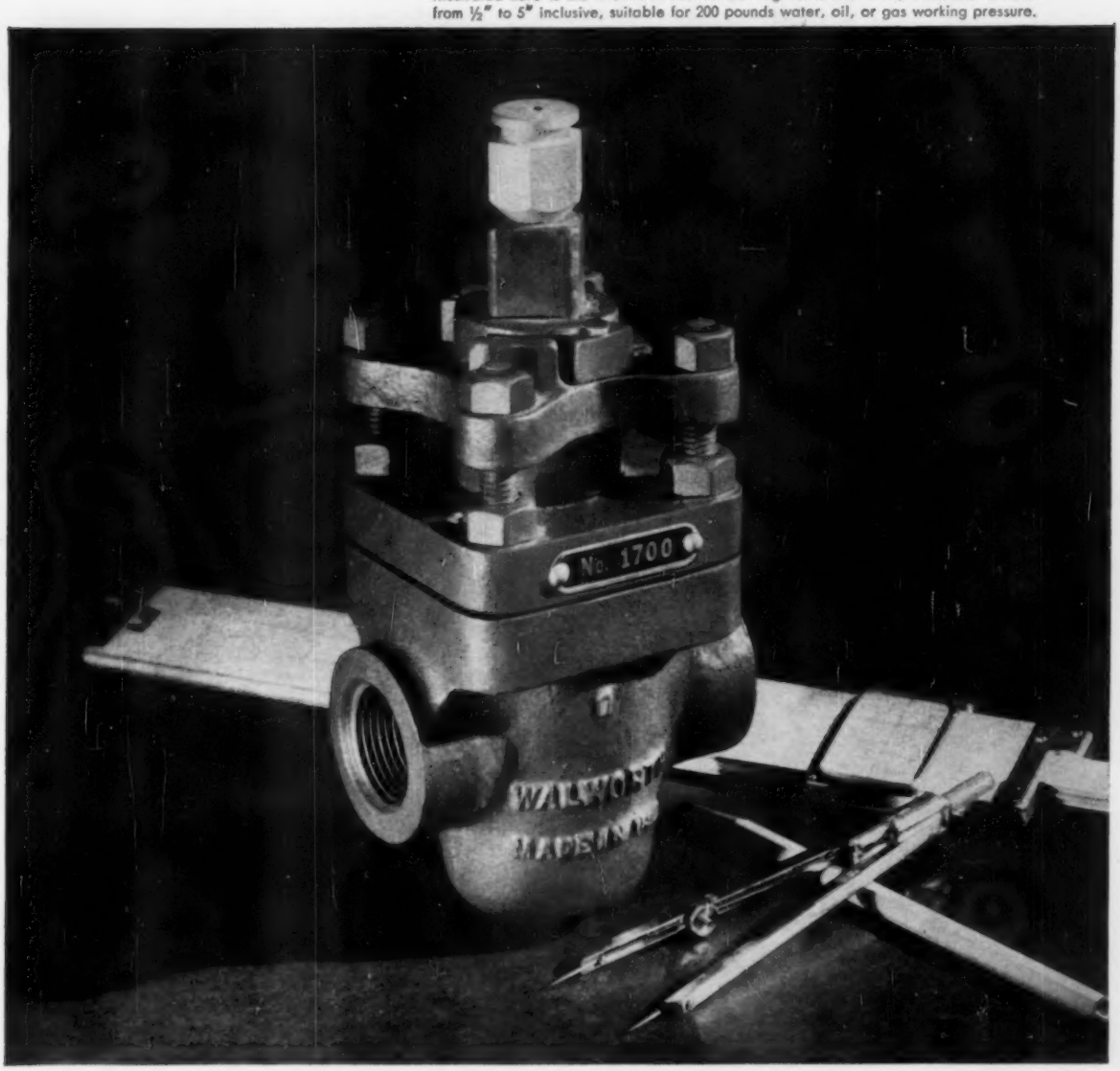
USS TRADE MARK

"OILWELL"

TRADE MARK

UNITED STATES STEEL

Illustrated here is the Walworth Lubricated Plug Valve No. 1700, available in sizes from ½" to 5" inclusive, suitable for 200 pounds water, oil, or gas working pressure.



problem-solvers for tough jobs

*LPV's by WALWORTH

If you're familiar with the basic advantages of Plug Valves, you know why Walworth Lubricated Plug Valves work so well in really tough spots. You know about their direct port opening . . . their dead tight shut off. Seating and sealing surfaces are fully protected from attack by fluids being handled by insoluble lubricants.

*Lubricated Plug Valves

Remember, you can get Walworth LPV's in all sizes . . . from ½ to 30 inches . . . for pressures up to 5000 psi and for vacuum service . . . in a number of different styles and patterns. For more information about LPV's and for your copy of the new Walworth LPV Circular, see your local Walworth Distributor.

WALWORTH

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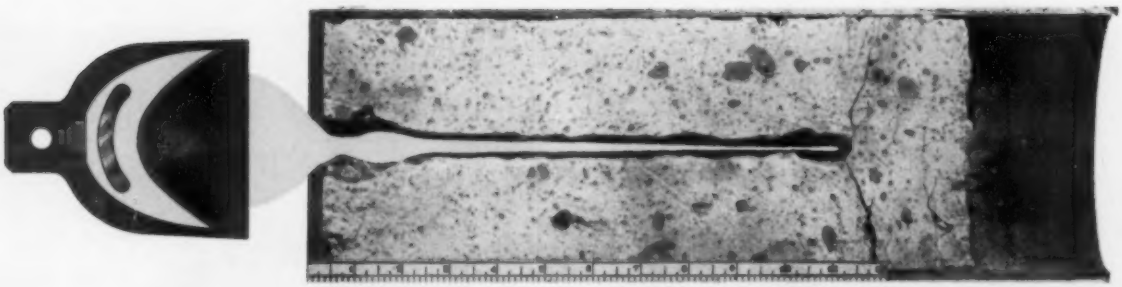
WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. SOUTHWEST FABRICATING & WELDING CO., INC. • M&H VALVE & FITTINGS CO. • WALWORTH COMPANY OF CANADA, LTD.



Welex Dyna-Jet fired in water through N80 steel casing into 16-day neat cement target produces a .58" entrance hole with 11.28" total penetration and 38.4 cc. hole volume.

WELEX dyna-jet

A NEW CONCEPT OF PERFORATING

205% ...**greater hole volume** than present casing jet . . . insures unparalleled production.

168% ...**greater penetration depth** than present casing jet . . . insures more flow area.

111% ...**greater entrance hole area** than present casing jet . . . insures free flow of crude into the borehole.

And ...**elimination of carrot or slug** is an added value which insures no plugging action in the perforation.

Now . . . Welex offers to the oil industry the Welex Dyna-Jet, the greatest improvement in perforating since the introduction of the jet process.

This completely new perforator, the Welex Dyna-Jet, was designed and developed to meet all requirements for the ultimate in casing perforating.

This new concept of perforating has been designed and developed to give greater hole size, increased penetration, greater entrance hole area, greater hole volume, elimination of the slug or carrot, with a minimum of explosive charge.

This new concept of perforating utilizes an all-new design of the jet perforator by the company that brought you the first jet perforator. This new design offers results never before possible with standard casing jets and insures greater production per unit of perforation.

dyna-jet: ANOTHER WELEX FIRST

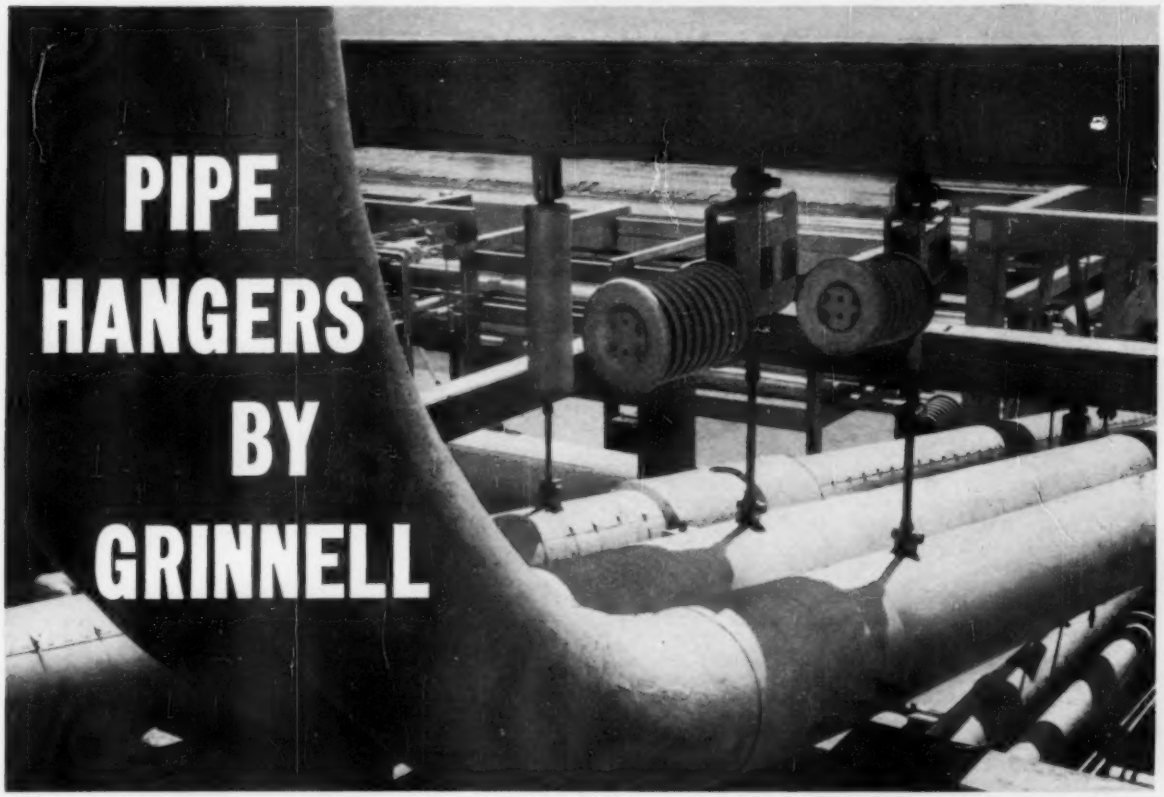
ORIGINATORS OF Welex JET PERFORATING

Welex JET SERVICES, INC.

GENERAL OFFICES: 1400 East Berry, Fort Worth, Texas

SALES OFFICES: Dallas — Wichita — Oklahoma City. DIVISION OFFICES: Houston — Midland — Tulsa — Denver. DISTRICT OFFICES: Abilene — Ardmore — Beaumont — Bowie — Corpus Christi — Cortez — Falfurrias — Farmington — Great Bend — Hobbs — Houma — Houston — Kilgore — Kimball — Lafayette — Lake Charles — Liberal — Odessa — Pampa — Pauls Valley — Pawhuska — Plainville — San Angelo — Shawnee — Shreveport — Snyder — Stillwater — Wichita Falls — Winfield.
WELEX OF CANADA, LTD.: Calgary — Drayton Valley — Edmonton — Red Deer.

At Tidewater's new Delaware Refinery...



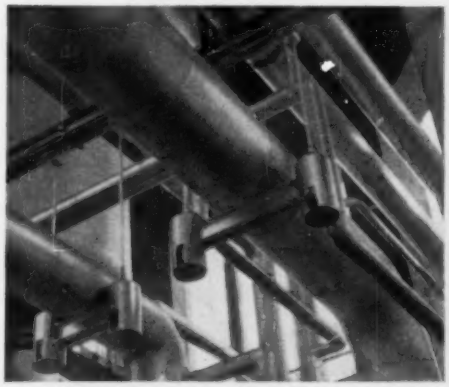
Tidewater Oil Company's new ultramodern $200-million, 5000-acre refinery, south of Wilmington, is the largest ever constructed at one time. Capable of processing 130,000 barrels of crude oil daily, the Delaware Refinery boasts eleven major processing units, including six of world-record size.

Pipe suspension problems, too, were bigger and more challenging at this record-breaking refinery. That's why Tidewater turned to Grinnell, America's #1 supplier of pipe hangers and supports.

A volume producer of pipe hangers, Grinnell backs up its high capacity and diversification with an efficient coast-to-coast network of warehouses and jobbers. Even complex hanger requirements very often can be met with hanger assemblies right off the shelf. This not only saves you time, but it can save you money, by cutting down on the number of special items which must be manufactured.

If you have a pipe suspension problem, you are invited to write: Grinnell Company, Inc., 256 West Exchange St., Providence, Rhode Island.

GRINNELL CONSTANT-SUPPORT HANGERS are engineered to maintain full safety factor. Constancy of support is mathematically perfect for all positions of travel. Note low headroom requirement. Load ranges from 30 lbs. to 32,260 lbs., with travels up to 12 inches.



GRINNELL VARIABLE SPRING HANGERS have precompression feature which assures operation of spring within its proper working range. Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. Available in 21 sizes for loads ranging from 50 lbs. to 28,200 lbs.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic fire protection systems • Amco air conditioning systems

J&L can help you with VALVES

We have sold valves for over half a century.

Use this experience! Its practical application by trained J&L men can be valuable to you when problems arise or technical specifications are involved.

In the meantime valves and fittings you need from day to day are in stock at your near-by J&L Store. Good valves, well selected.

Yes, *J&L can help you with valves.*

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

6–GA

Always Stronger Than They Need Be!

MIDWEST

WELDING FITTINGS

Below are photographs of two of the many tests that have been made of Midwest Welding Fittings. The results are *always* the same . . . the seamless pipe to which the fittings are welded invariably bursts. There is *never* any sign of fitting failure or weakness.

There's good reason for this. We make elbows and tees of inherently stronger metal . . . the Midwest exclusive method of manufacture enables us to maintain greater minimum wall thickness, and to reinforce the fittings at points of greatest stress. For the many other advantages of Midwest Fittings, ask your Midwest distributor or write us for Catalog 54.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

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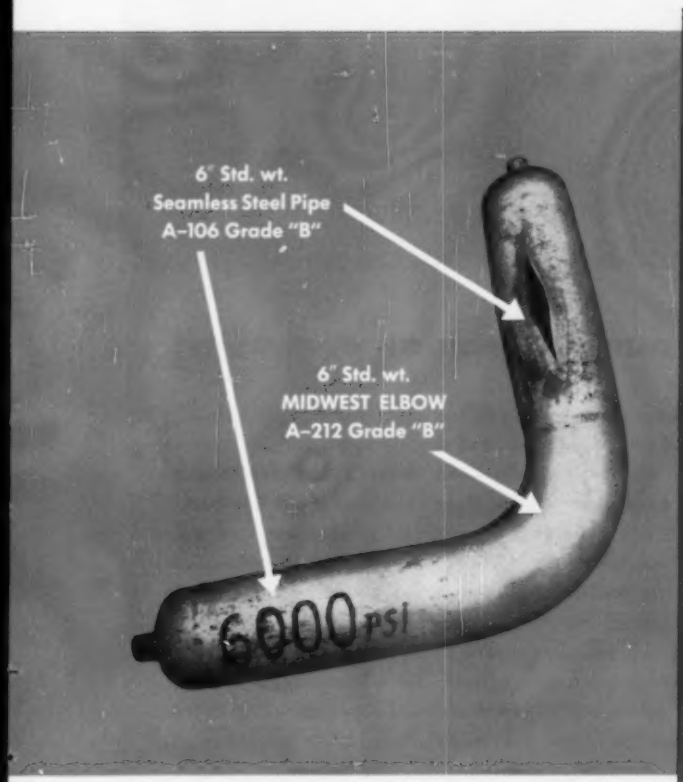
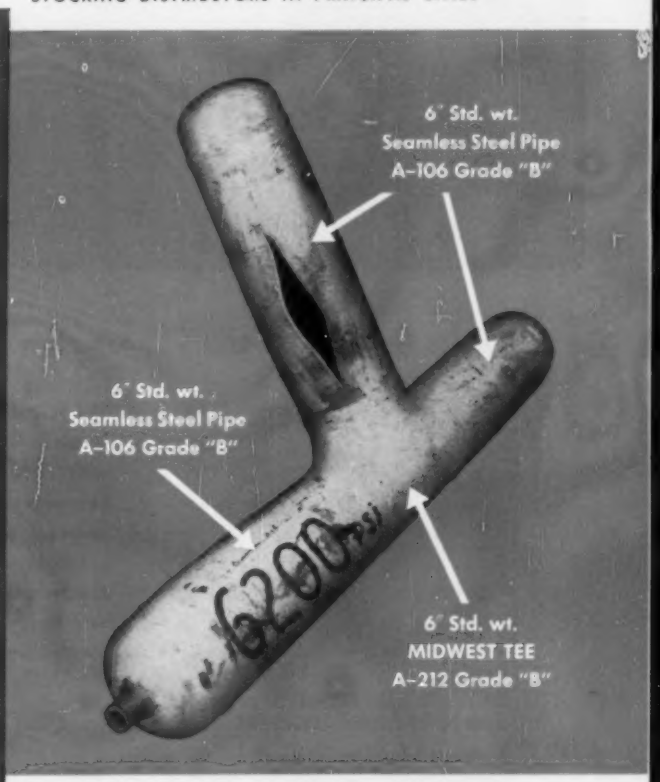
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES



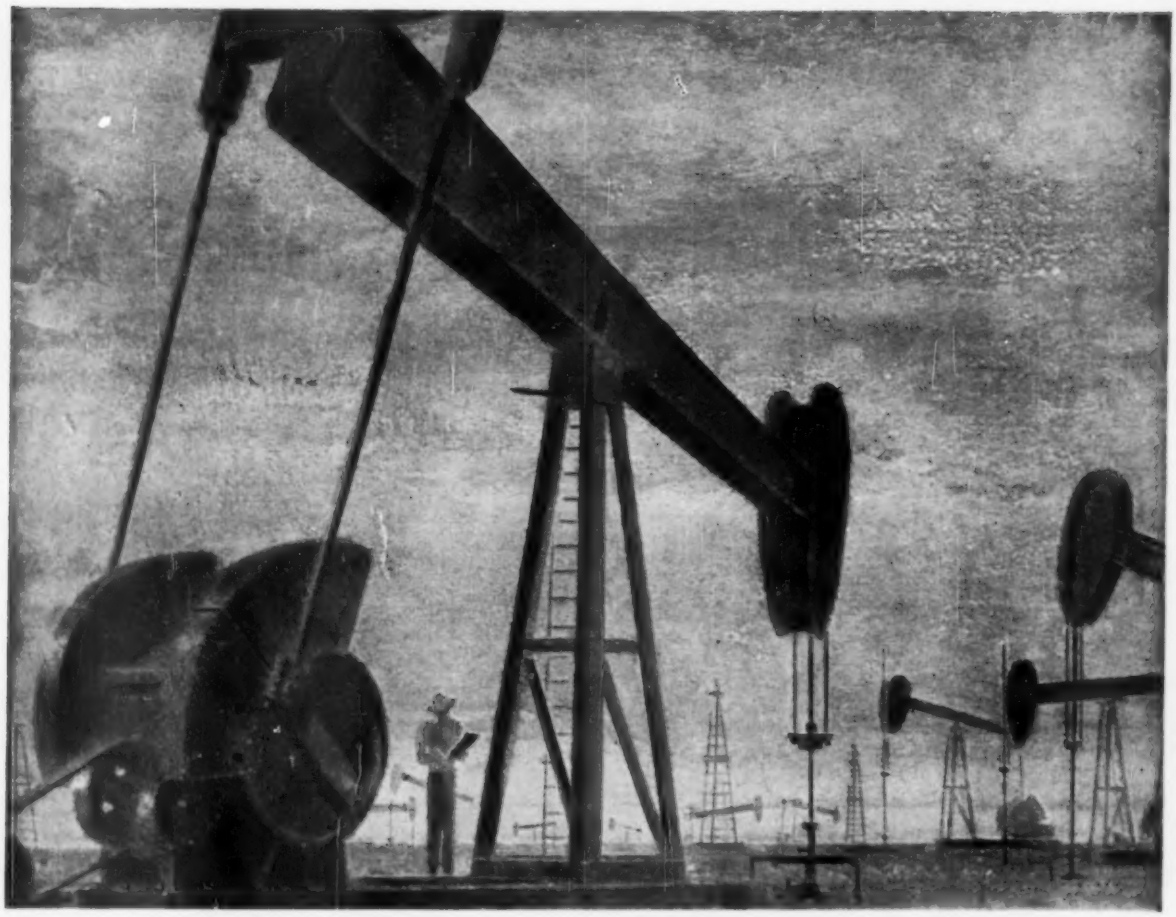
Typical bursting test of stock Midwest Welding Elbow. As is always the case, failure occurred in the seamless pipe while the elbow was undamaged. Bursting pressure was 6000 psi . . . considerably above the required code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)



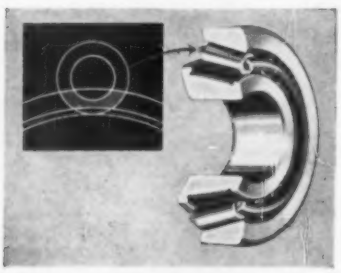
Bursting test of Midwest Welding Tee taken at random from stock. As always, the failure occurred in the seamless pipe and not in the fitting. The non-shock internal bursting pressure of 6200 psi is well above the code minimum for seamless pipe. (Minimum allowable bursting pressure for 6" standard weight A-106 Grade B seamless steel pipe is 4438 psi.)

7761

MIDWEST **WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS**



Built to stand up . . . under 'round-the-clock pressure!



HIGHER FLANGE IMPROVES ROLLER ALIGNMENT

As shown by the gray area above, the higher flange provides a large two-zone contact area for the roller heads. This greatly reduces wear—practically eliminates "end play". Larger oil groove provides positive lubrication.

The flow of America's vital oil can't be regulated by a time clock! These bobbing pumps work around the clock, around the year—with virtually no attention whatever! Dependable Bower Roller Bearings are more than proving their ability to stand this back-breaking pace—doing it with a minimum of maintenance cost and down-time. That's because important Bower Spher-O-Honed design features, like the one shown at left, have reduced bearing failure to a rarity. Whatever test *you* put them to—tractors, machine tools, jet engines—you'll find that Bower Spher-O-Honed Bearings will last longer and operate more efficiently. Let a Bower engineer show you the many advanced design features and superior quality of the complete Bower line. There are tapered, straight and journal roller bearings for every field of transportation and industry.

BOWER ROLLER BEARING DIVISION
FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 14, MICHIGAN

BOWER ROLLER BEARINGS

this booklet tells...

OIL and GAS DEPARTMENT
A brief guide to the many, often unique financial services provided by Empire Trust Company to individuals, independent operators, companies and investors in the oil and gas industry.
Empire Trust Company

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Empire Trust Company offers specialized, fully integrated, and – we believe – unique combinations of financial and technical supervisory service. The user of any of our services may benefit from the scope of our activities in all the others.

Empire Trust Company has maintained an active interest in the oil industry for many years. This long-standing association has resulted in a thorough understanding of the industry and its problems. Located in the heart of New York's financial district, the bank is in the closest possible touch with the sources of capital and the most current economic information.

THIS BOOKLET WILL SHOW YOU HOW WE CAN SERVE companies, groups and individuals who are interested in the various ways of investing funds in the oil and gas industry.

We shall be pleased to send, upon request, a copy of this booklet without charge or obligation. Merely write to the address below.

Empire Trust Company

Oil and Gas Department, Division B

20 Broad Street, P. O. Box 98, New York 5, N. Y.

Member Federal Deposit Insurance Corporation

THE HAMMOND
DIALIFT

the only membrane type conservation tank

... with full-rated vapor and product capacity at all times

... with a membrane that cannot come in contact with product

... with vapor space that can be isolated for inspection and maintenance without taking tank out of service.

Principle of the Hammond Dialift

A—DIALIFT DIAPHRAGM rises and falls to accommodate expanding and contracting vapor.

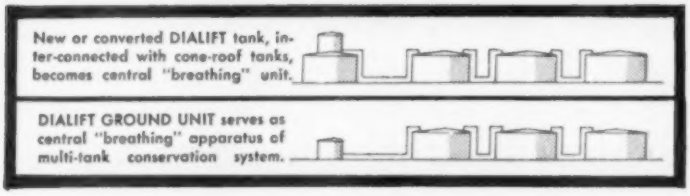
B—Vapor passes to and from tank and DIALIFT through simple elbow connection.

C—DIALIFT and tank have full-rated capacity.

D—Membrane can't come in contact with product.

E—DIALIFT can be isolated for maintenance and inspection, product tank stays in service.

The most efficient and economical vapor conservation system for new or old tanks.


New or converted DIALIFT tank, inter-connected with cone-roof tanks, becomes central "breathing" unit.
DIALIFT GROUND UNIT serves as central "breathing" apparatus of multi-tank conservation system.

THE HAMMOND DIALIFT consists of a gas-tight Vulcalock membrane attached to the inside periphery of a cylindrical metal housing to become a "breathing" apparatus to accommodate the expanding and contracting vapor as developed in product storage tanks. The DIALIFT can be used as a single conservation unit by being attached to the roof of a product storage tank or as a central "breathing" system by being manifolded to a number of product storage tanks. There are two forms of installation:—Ground type manifolded to a number of tanks to form a conservation system and integrated type whereby the DIALIFT is attached to the roof of a tank for vapor conservation for one or a number of tanks. The DIALIFT is completely isolated from the product storage tank. Vapor passes between the tank and DIALIFT through a vaporline connection. It is easy to convert old cone roof tanks to efficient vapor-saving DIALIFT installations by attaching a DIALIFT housing with membrane to the roof of the old tank and connecting the vaporline between the tank and DIALIFT.

THE HAMMOND DIALIFT ELIMINATES BREATHING LOSS AND REDUCES FILLING LOSS

Write for dialift catalog 55DL

HAMMOND IRON WORKS

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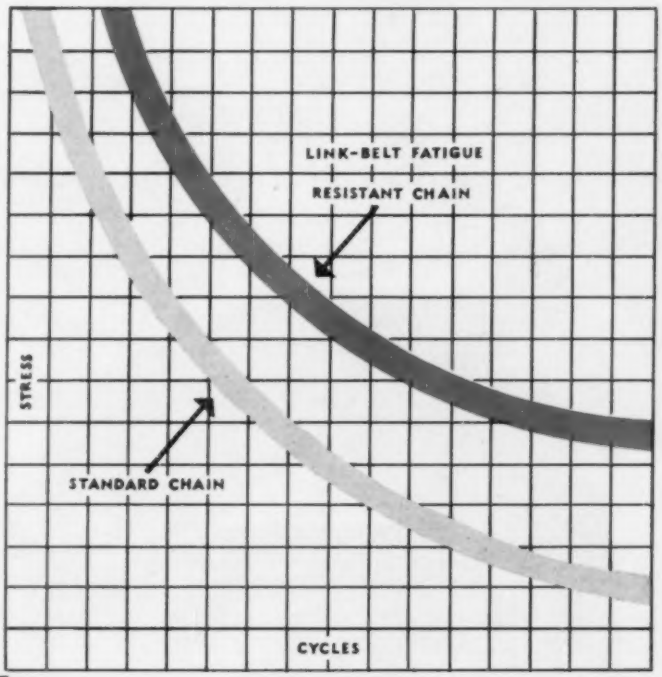
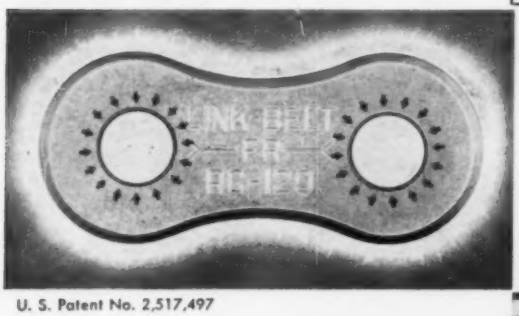
How important is LINK-BELT's FR® FATIGUE RESISTANT to roller chain life?

Fatigue Resistant processing of sidebars develops greater dynamic strength for hard-working oil field drives . . . increases endurance limit

If your drilling is all too often interrupted by failure of ordinary roller chain, sidebar fatigue may be your problem . . . and then the Link-Belt FR process is your answer! By concentrating resistant compressive stresses in the area around the pitch hole, Link-Belt adds substantially greater *dynamic strength* to its Precision Steel Roller Chain. The difference—shown in the chart at right—gives Link-Belt drives the ability to shrug off repeated high loads that otherwise may cause early failure.

Standard on Link-Belt oil field roller chain, FR is supported by many more "extras." Any leading supply store in the field will gladly explain their importance, and furnish you a copy of Link-Belt Catalog 2780.





U. S. Patent No. 2,517,497

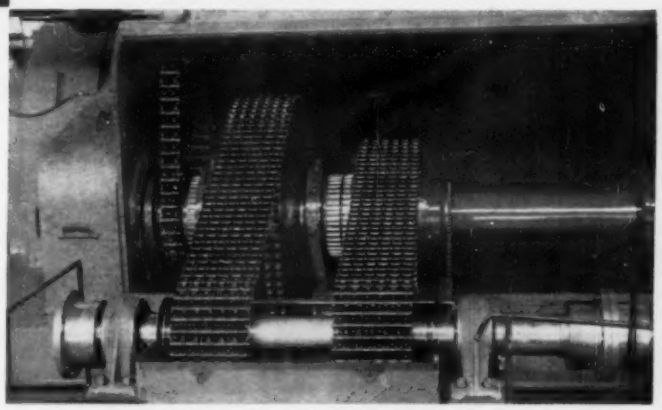
LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 14,671

NATIONAL SUPPLY 1625-DE DRAWWORKS FOR DIESEL-ELECTRIC DRILLING RIGS is equipped with Link-Belt FR roller chain for extra dependability. Other important Link-Belt roller chain extras:

- SHOT-PEENED ROLLERS with greater fatigue life.
- PRE-STRESSING for load-bearing uniformity.
- E-Z ASSEMBLY to facilitate field installation.
- SHEPHERD'S CROOK COTTERS — won't shake loose.
- DOUBLE BOXING — most effective in the field.

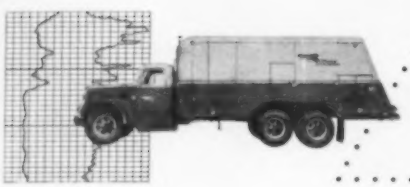


RESERVOIR EVALUATION PROBLEMS?

GET A **HALLIBURTON**

REPORT ON YOUR WELL

For complete interpretive service, Halliburton offers you survey reports necessary for your reservoir evaluations. To gain the benefits of comprehensive analyses that eliminate "guess work", continue to rely on Halliburton's "Electronic Eyes For Oilmen".

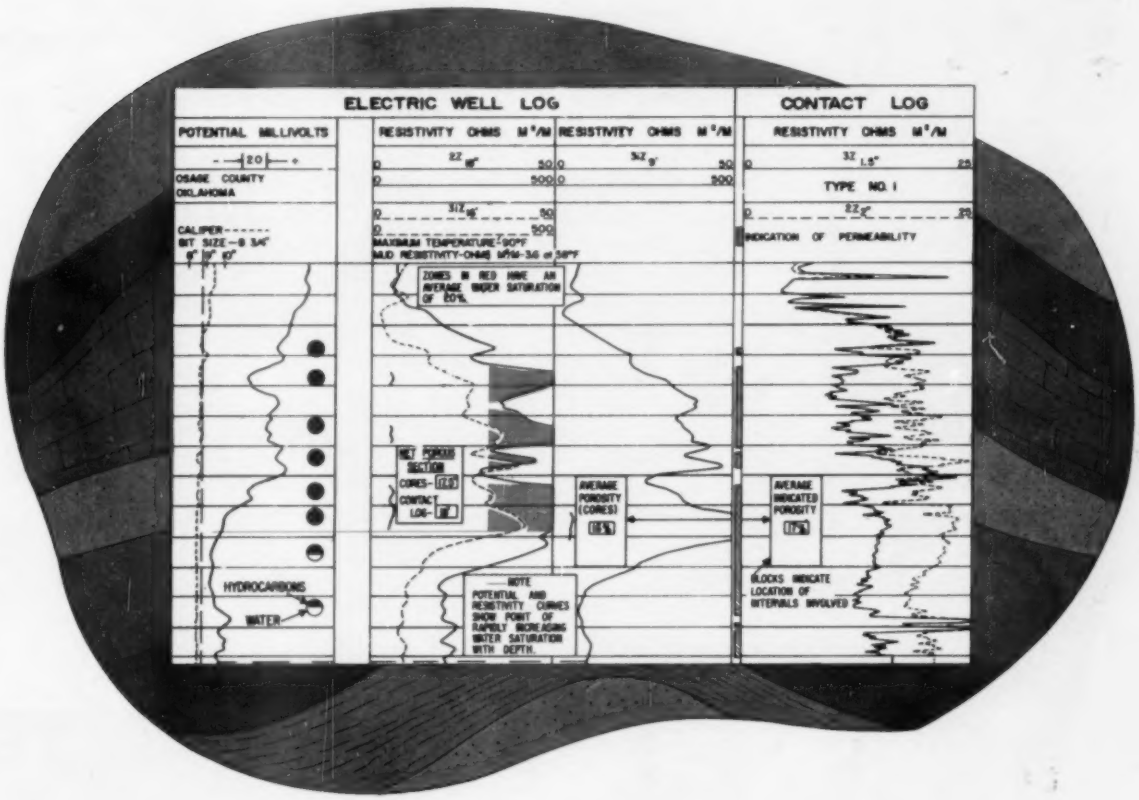


HALLIBURTON

OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

HALLIBURTON WELL LOGS ARE INVALUABLE FOR:

- **Defining thin zones**...To solve testing and production problems.
- **Locating physical changes**...To find lithological variations and changes in fluid distribution.
- **Utilizing comparative information**...To correlate data derived from other sources—in this example, from core analysis.
- **Providing an integrated source** of technical information for oilmen.



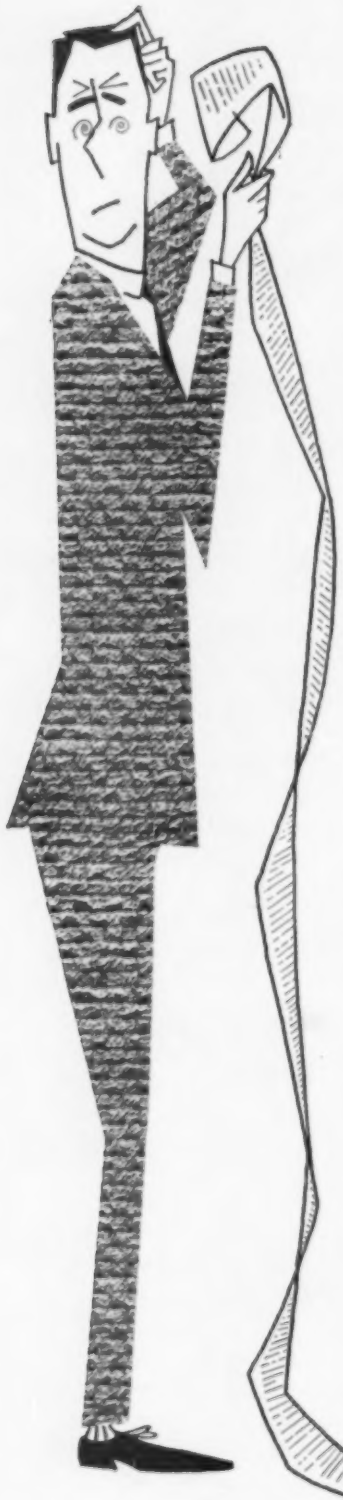
The Electric Well Log and the Contact Log shown here are examples of the surveys Halliburton offers to determine the characteristics of reservoirs encountered in drilling operations.

Other types of logs may be desirable to obtain this basic information concerning a prospective pay horizon. For example, the Radiation-Guard Log will evaluate carbonate rocks just as the logs here have evaluated a Pennsylvanian sandstone formation.

Consult your Halliburton Electrical Well Service Engineer for helpful information concerning the method best suited to solve your reservoir evaluation problems.

ELECTRICAL WELL SERVICES

"ELECTRONIC EYES FOR OILMEN"



You say you've got a problem, Mister?

You say you're looking for the right steel tube analysis to withstand acids, corrosives, oxidation, high pressures and high temperatures? Mister—you *have* got a problem.

But don't give up. You can get help. National Tube has been studying refinery problems of all kinds for over 60 years. We've kept case histories of these problems and their solutions on file, and from this vast, comprehensive knowledge we've developed over two dozen different steel analyses—answers to almost every refinery tubular problem in the book.

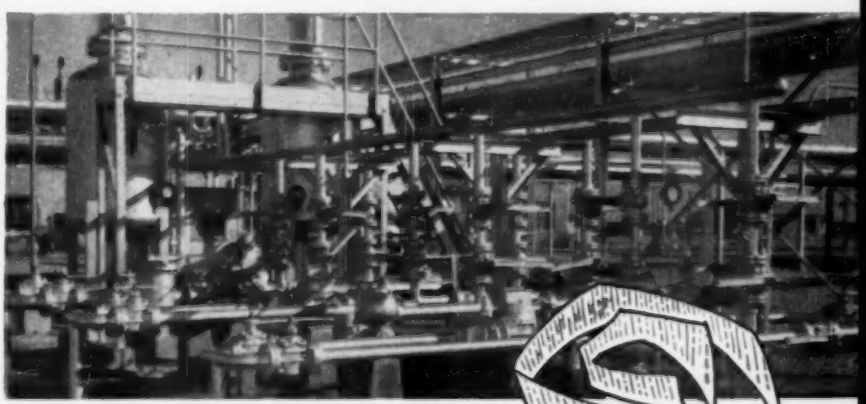
Every one of these analyses has been tested and retested in actual refinery service so that we know what can be expected of each. And, in addition to the 24 analyses shown here, other chemical compositions are available in tubular products, and a wide variety of temperature problems are under study.

So, bring your problem to us. Our expert Mill Service Force will do everything it can to help you find a solution. This force is also available for field consultation. And there is a good chance we can save you money, by finding a good alloy, at low cost, that will meet all the requirements of the job.

Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

EXAMINE THESE TWO DOZEN DIFFERENT NATIONAL TUBE ANALYSES:

Carbon	5 Cr, ½ Mo	17 Cr
Carbon, ½ Mo	5 Cr, ½ Mo, 1½ Si	18-8
1 Cr, ½ Mo	7 Cr, ½ Mo	18-8 Ti
1¼ Cr, ½ Mo	8 Cr, ½ Mo	18-8 Cb
2 Cr, ½ Mo	8 Cr, 1 Mo	18-8 Mo
2¼ Cr, 1 Mo	9 Cr, 1 Mo	25-20
2½ Cr, ½ Mo, ¾ Si	12 Cr	3½ Ni
3 Cr, 1 Mo	12 Cr, Al	5 Ni



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL SEAMLESS PIPE AND TUBES

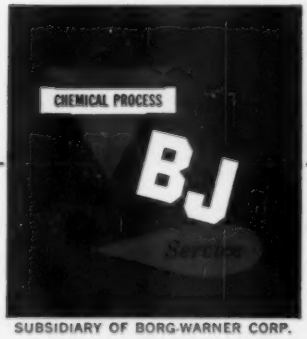
UNITED STATES STEEL

New BJ Service 111-TA Cementing Units

High Volume Cementing At New High Efficiency

510 hp...56 cfm slurry...10,000 psi rating...all combined for your benefit!

1. **Diamond T Cab-Over Design** gives best equipment arrangement for optimum efficiency.
2. **Gardner-Denver Cementing Pump,** 4½ x 8 triplex, 10,000 psi rating, newly designed for high-volume service.
3. **Gardner-Denver Mixing Pump,** 4½ x 8, 3,000 psi rating, supplies water to mixer, provides annulus pressure, and may be used for added displacement of slurry.
4. **Rugged 335 hp Truck Engine** also drives cementing pump.
5. **Deck-Mounted 175 hp Engine** drives mixing pump.
6. **Displacement Tank,** 200 cu. ft., two compartments.
7. **Suction Manifold** permits fluid withdrawal from either or both tank compartments to either or both pumps.
8. **High Pressure Discharge Manifold** provides extreme flexibility of hook-up. Each pump has individual discharge line, and both pumps may discharge through a single line. With both pumps in tandem a displacement rate of 96 cfm is attainable. Annulus may be pressured to 3,000 psi while squeezing slurry at 10,000 psi by a single pump truck and one operator. Time for reversed circulation is minimized by advanced manifold design.
9. **Hose Equipment.** Fifty-four feet of 2" steel discharge hose and 50 feet of 2" steel line with unions.
10. **Multi-Jet Mixer**—provides a pre-set slurry consistency from the first sack. No "hunting" for the correct slurry weight.



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WRITE today for illustrated bulletin, or contact your nearest field service office.

BJ SERVICE, INC.

General Offices and Laboratory—Long Beach, California

Stations Throughout California, Rocky Mountain and Permian Basin Areas

Chemical Process

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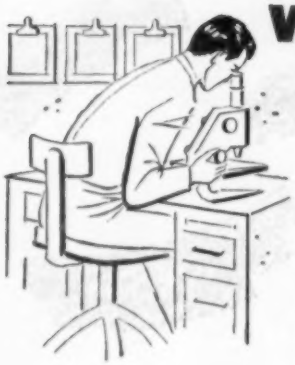
Stations Throughout the Mid-Continent Area

Microscopic Enemies?

Magnification 860X

Layne Research Defends Your Well Water Supply



Shown here is an actual photograph of one of the many microscopic organisms which may occur in any type water supply.

Layne Research is called upon when well capacity is reduced. Layne Research finds out why. Production records, water analysis and microscopic examinations are some of the methods used to find the reason. Layne Research, thru years of experience in "recovering lost water," selects the correct Laynite material and method to restore well capacity.

IDENTIFY AND PRESCRIBE — that's what Layne Research does for each individual well water problem.

Only Layne Offers Complete Service: *Research* • *Analysis* • *Design* • *Wells* • *Pumps* • *Maintenance* • *Engineering*

1882 — 1957 Layne 75 YEARS OF PROGRESS

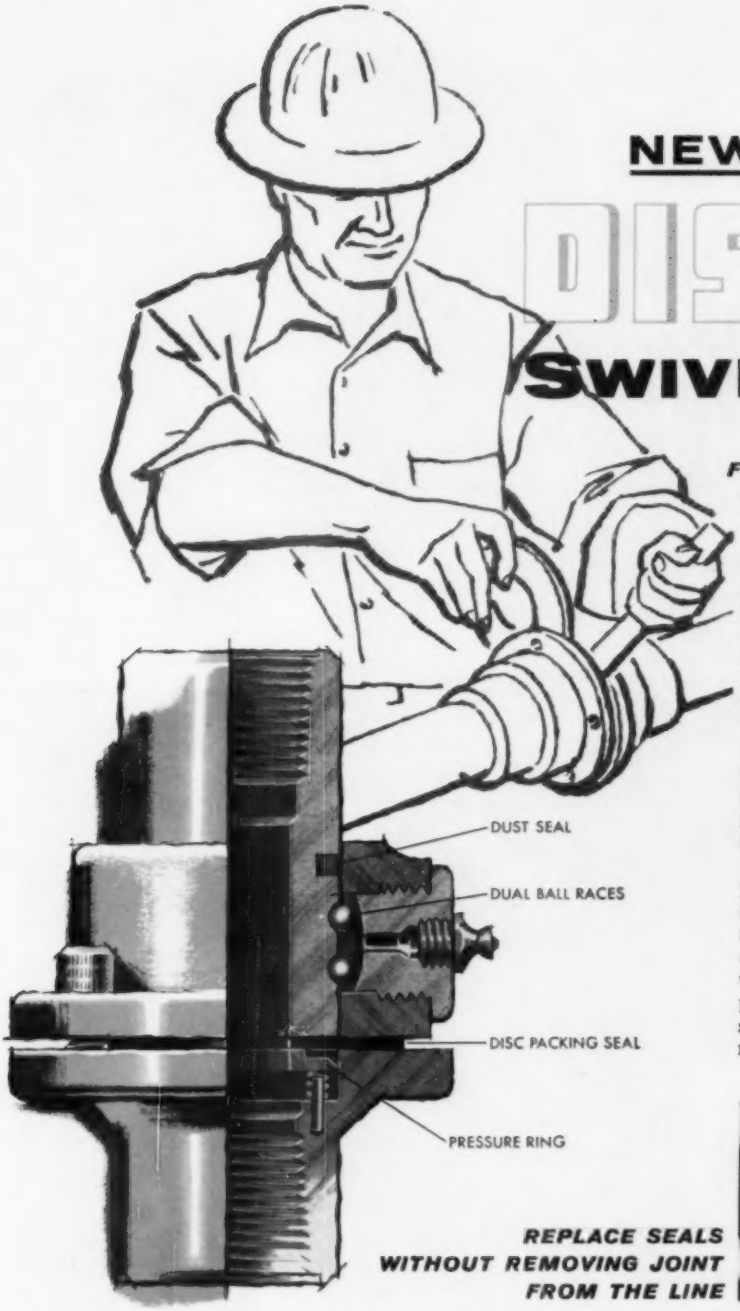
WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT

LAYNE & BOWLER, INC. MEMPHIS

General Offices and Factory • Memphis 8, Tennessee

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

NEW CHIKSAN DISCPAK SWIVEL JOINTS



REPLACE SEALS WITHOUT REMOVING JOINT FROM THE LINE

FOR STEAM AND HOT GAS SERVICE

Created specifically for service on lines employed in steam and hot gas service, the Chiksan Discpak embodies a new construction design which permits packing units to be replaced without removing the joint from the line. The outer housing of the Discpak is cut apart at the packing chamber and both ends are flanged at the cut. Four allen-type cap screw bolts are used to secure the flanges. A disc-seal, housed between the two members, provides a fluid-tight seal between rotating and stationary members of the Discpak Swivel Joint. A spring loaded pressure plate holds the packing in sealing position against the swiveling member.

The new Discpak has a maximum temperature rating of 600° F. and a maximum pressure rating of 300 psi. All turning movement in the Discpak takes place on a double row of precision ball bearings. Write today for literature and prices. If your plant or equipment lines utilize hot gas or steam, it will pay you to know about this new field-proven Discpak swivel joint.

To replace the disc-seal, simply remove four allen screws and spread line slightly with a flat metal bar.

CHIKSAN

CHIKSAN COMPANY, 330 No. Pomona Avenue, Brea, California
A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

Please rush me a copy of your new Discpak Bulletin

NAME_____

COMPANY_____ TITLE_____

CITY_____ ZONE____ STATE_____

Dept. 310

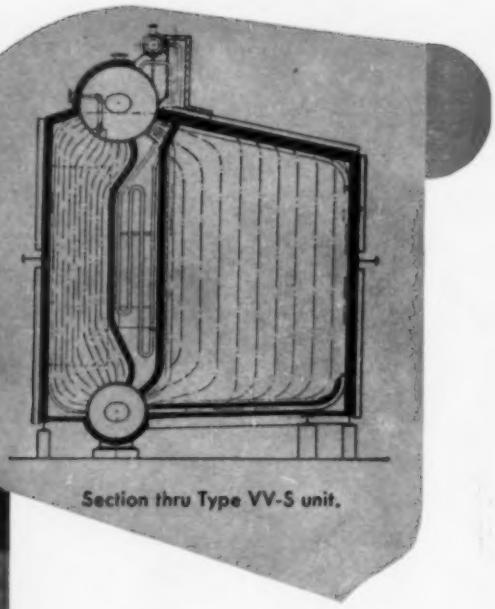
SEND FOR BULLETIN

New Discpak Bulletin 100 describes in detail the many features of this new swivel joint including full mechanical specifications.

57-26

More Steam with Fewer Dollars

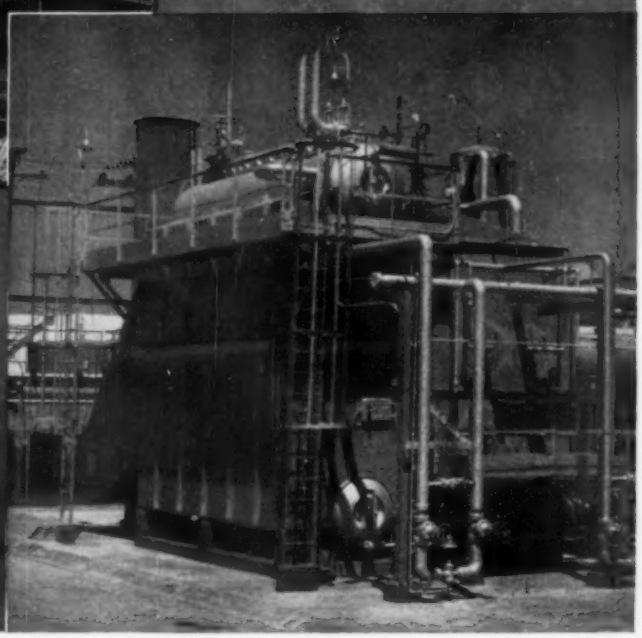
Vogt TYPE VV-S STEAM GENERATORS



Section thru Type VV-S unit.

Two 50,000 #/hr. units under erection at an Air Force Base.

A 65,000 #/hr. unit in a Texas Petroleum Refinery



- ★ Headerless construction for full unrestricted water circulation.
- ★ Large water storage capacity and correspondingly greater steam relieving space.
- ★ Long, narrow furnace ideal for oil or gas fuel.
- ★ Completely steel encased for "out-in-the-open" operation.
- ★ Simple slab foundation.
- ★ Capacities from 50,000 pounds to 100,000 pounds steam per hour.

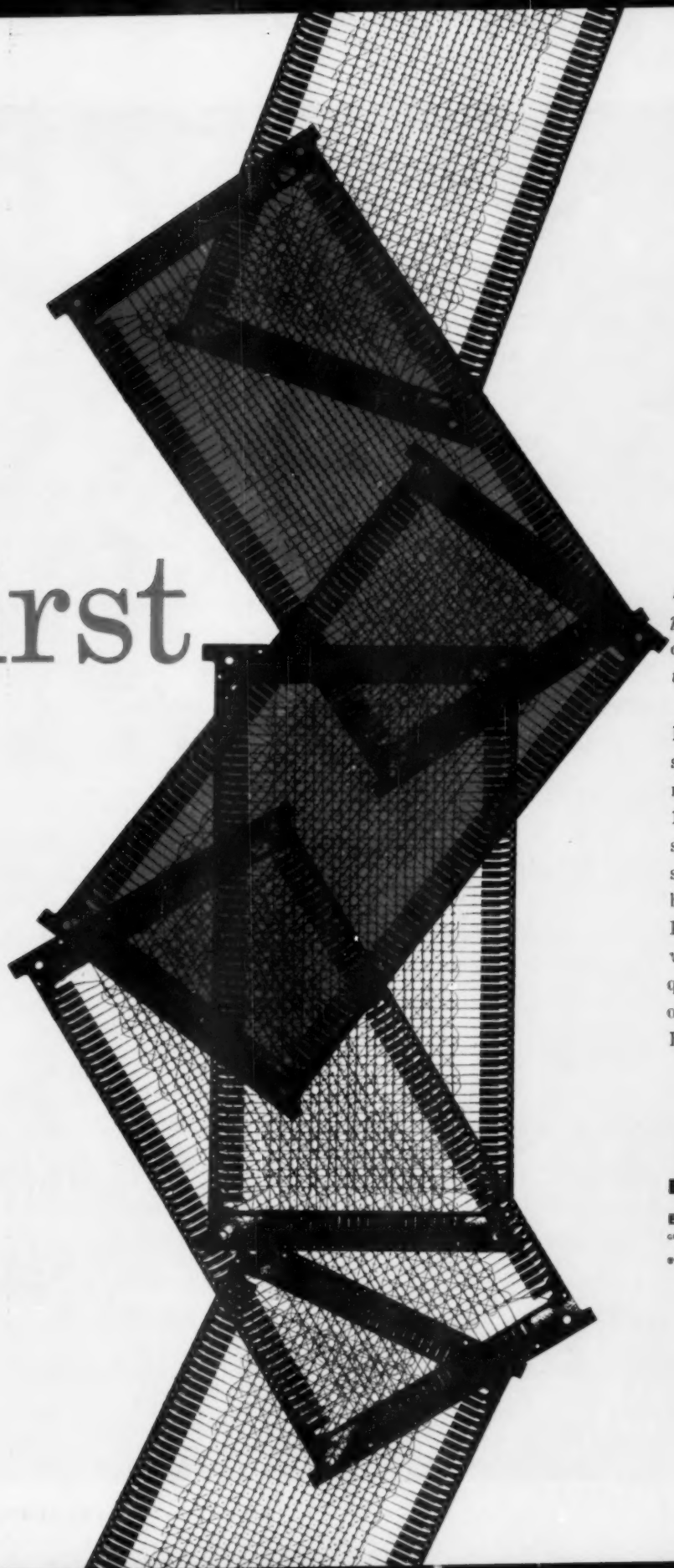
OTHER VOGT PRODUCTS

Drop Forged Steel Valves, Fittings and Flanges—
Petroleum Refinery and Chemical Plant Equipment
Heat Exchangers
Ice Making and Refrigerating Equipment

HENRY VOGT MACHINE CO.

Box 1918, Louisville 1, Kentucky

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati



first

Burroughs is first with the full power of a giant electronic computing system at half the cost... the Datatron 220.

First too, a medium-priced system with a full magnetic core memory, increasing productivity 10 to 15 times over previous systems. Designed for *both* scientific computation and business data processing. Delivery of the Datatron 220 will begin during the 2nd quarter of 1958. For a summary of its benefits, write to Dept. L, Pasadena, California:

Burroughs

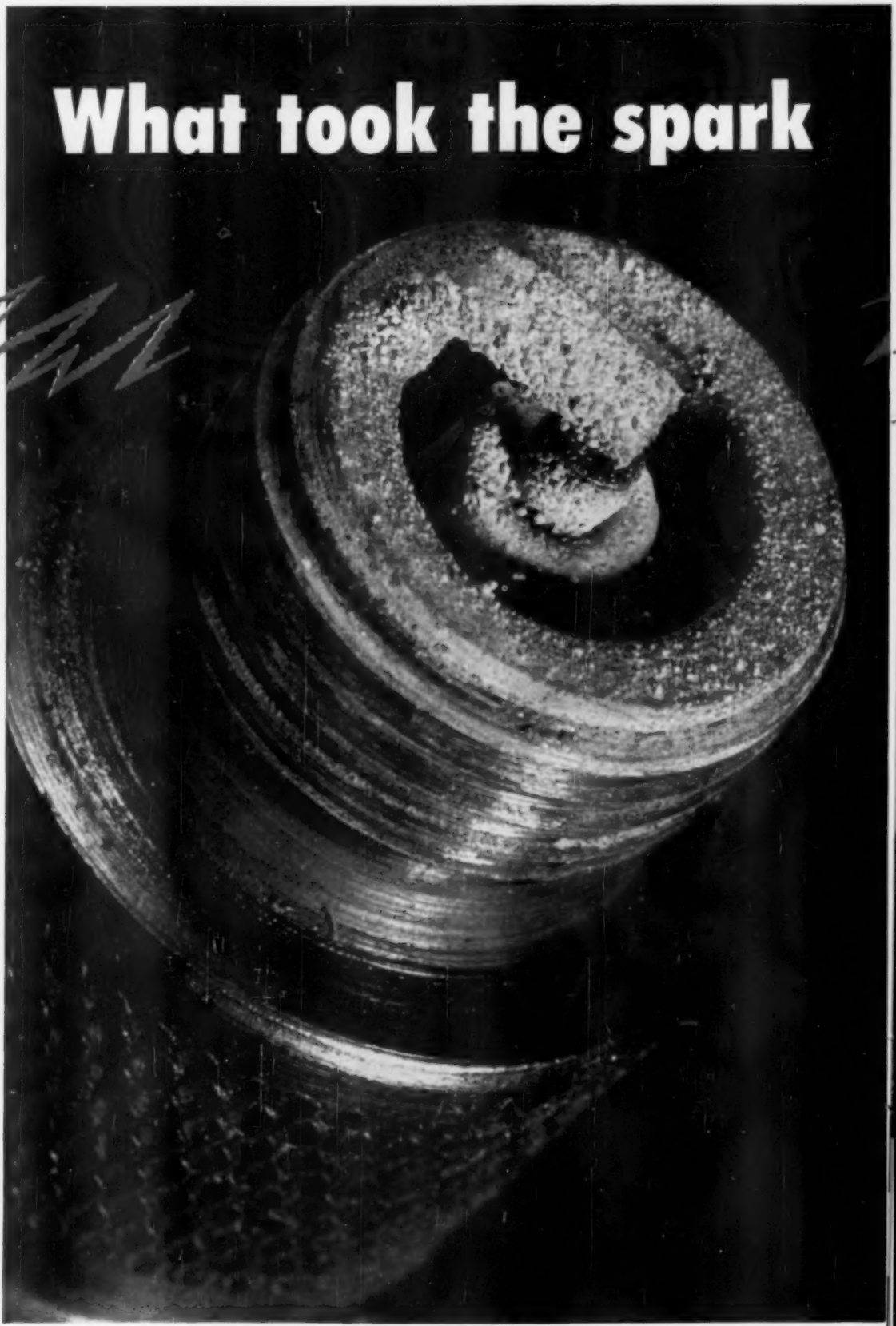
ElectroData DIVISION

BURROUGHS CORPORATION

GRAPHIC • MECHANICAL • ELECTRO-MECHANICAL • ELECTRONIC SYSTEMS

extending the usefulness of man's mind

What took the spark

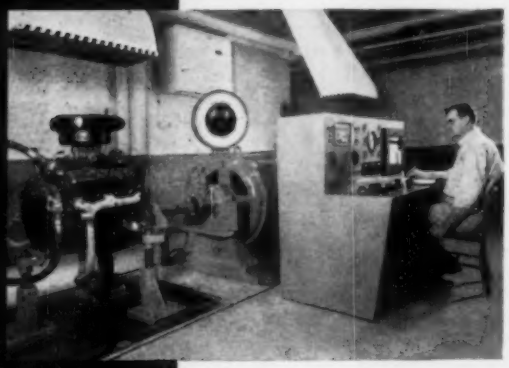


This unretouched photograph, taken by Edmund F. Hawes, UOP Staff Photographer, was awarded First Prize in the 1956 ASTM Photographic Exhibit.

out of this plug?

smoke

The old problem of the fouled-up spark plug is less acute today because of modern improvements in petroleum refining. Most refiners are taking the utmost precautions to make sure that the motor fuels they produce burn clean, quick and with the full power needed for today's high compression, high-speed engines. Throughout the refining industry research technicians are constantly checking the fuels their refineries produce to help guard against plug fouling and to maintain all the high performance characteristics demanded by today's automotive engines. In this way they are helping to make and keep the products you market salable. Here at UOP, in our business of developing processes for the manufacture of motor fuels, we also never take our eyes off the performance of the end product. Our research and technical staffs are constantly concerned with the fuels made by UOP processes to make sure that these will have the performance qualities that will give their ultimate users full satisfaction. This is only part of the broad contribution research is making toward the salability of products from petroleum. Wherever you market, you can be sure that "men of science" are constantly working to keep the products you sell at the quality level your customers demand.



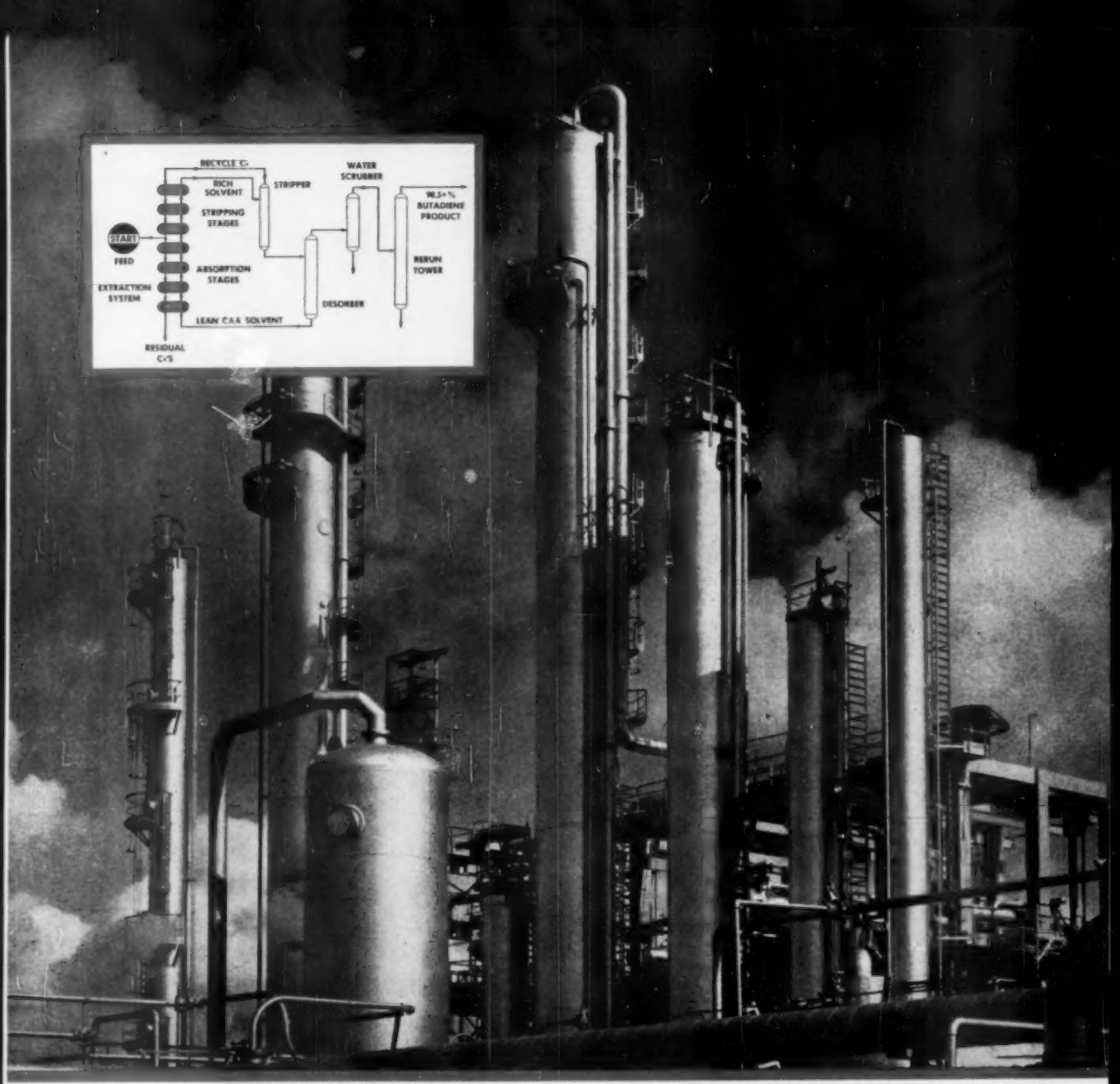
This is a modern V-8 engine and dynamometer used in the UOP Engine Laboratory to analyze all phases of motor fuel performance including engine cleanliness test. It is one of the tools used by UOP technicians to develop methods for producing fuels having all of the characteristics necessary to satisfy the petroleum marketers' most demanding customers.

UOP

More Than Forty Years Of Leadership
In Petroleum Refining Technology

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.



50,000 TONS PER YEAR BUTADIENE EXTRACTION UNIT OF HUMBLE OIL & REFINING COMPANY, BAYTOWN, TEXAS

CAA BUTADIENE EXTRACTION CAN GIVE YOU LOWEST OPERATING COSTS

Esso Research and Engineering Company offers you the most economical *Butadiene Extraction Process* ever developed, with a high recovery rate and high purity of product.

Superior service factor, elimination of corrosion and waste disposal problems, and low utility requirements of the *CAA Process*, demonstrated in years of commercial operation, mark it as another achievement of Esso Research – 38 years of process developments made available to refiners around the world.

High purity butadiene, now used principally in synthetic rubber production, has a growing value as a chemical intermediate. The cuprous ammonium acetate solvent (CAA) permits a higher recovery of 98.5+% purity butadiene than any other extraction process.

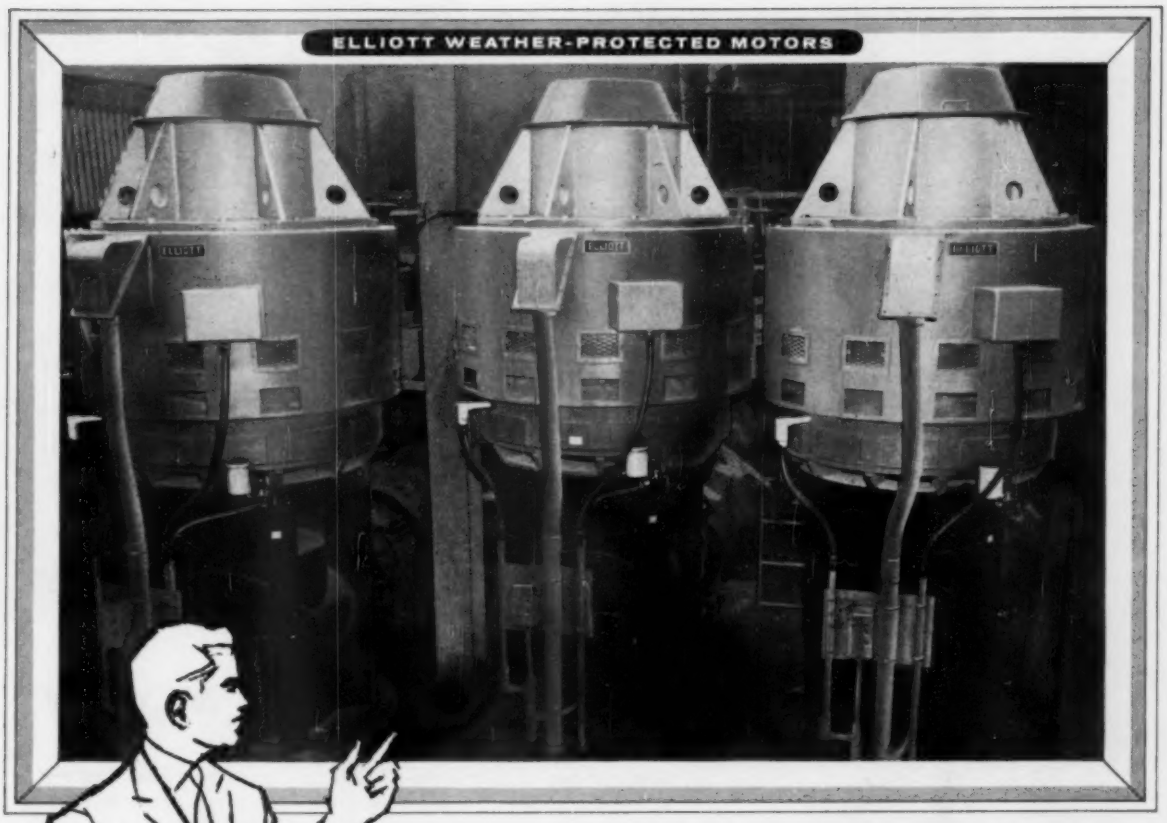
Licensees enjoy benefits of new *CAA* process developments. We would welcome your inquiry on the part this important process can play in *your* expansion plans.

ESSO RESEARCH AND ENGINEERING COMPANY

15 West 51st Street, New York 19, N. Y.

Your key to progress... an Esso Research process

ELLIOTT WEATHER-PROTECTED MOTORS



"This outdoor installation saved us $18,000"

Three Elliott 450-hp, 720-rpm, hollow-shaft weather-protected induction motors above drive pumps through shafts 65 feet long.

A well-known chemical plant decided to build a new pumping station on the Mississippi River. It planned to construct a special building in which totally-enclosed fan-cooled motors were to be installed. Naturally, construction like this runs into a lot of money.

Elliott Company engineers suggested using Elliott weather-protected motors mounted on a caisson. Since such motors are designed to withstand rugged outdoor use, a building was unnecessary. In the completed outdoor installation, pictured above, the savings added up to $18,000.

The same thing could happen to you. The economy of outdoor construction has been proven in installations from coast to coast. In all kinds of weather—rain or shine, snow or sleet—Elliott motors keep right on operating. Having unparalleled experience with outdoor motors, Elliott engineers are in a unique position to serve you. For quick action, contact your nearby Elliott District Office or write Elliott Company, Ridgway Division, Ridgway, Pa.

RT-3

ELLIOTT Company

Turbine-Generators • Turbines • Motors • Generators • Deaerating Heaters • Ejectors • Condensers • Compressors • Turbochargers • Tube Cleaners • Strainers

SAVING LIVES AND MONEY

TEXAS EMPLOYERS' INSURANCE ASSN. DALLAS, TEXAS

Symbol of leadership in
WORKMEN'S COMPENSATION
Insurance

•

Outstanding opportunities in Sales, Claims, Engineering and other departments for qualified young men.

The prevention of injuries to workers should be a basic concern of every employer. Accident prevention eliminates needless suffering, promotes better employee morale with less turnover, improves efficiency, and helps reduce the cost of workmen's compensation insurance. Regardless of where you insure, the responsibility, initiative and interest in safety must come from within your organization if real results are to be obtained.

When Texas Employers' Insurance Association carries your workmen's compensation insurance you can combine your own initiative with the technical ability and know-how of TEIA's staff of highly-trained Safety Engineers for really *superior* results. A "tailor-made" program will include help in planning and improving your accident prevention activities, technical assistance at *any* location in Texas, and aid in solving any occupational disease problems which may exist.

Placing your workmen's compensation insurance with Texas Employers' will make available to you the most modern and successful methods known for combating industrial accidents. For the benefit of your employees and your company, investigate the services offered by Texas Employers'.

For full information, call or write our nearest service office listed below, or write direct to:

TEXAS EMPLOYERS
Insurance Association

A. F. ALLEN, Chairman of the Board
BEN H. MITCHELL, President

HOME OFFICE Employers Insurance Building DALLAS, TEXAS

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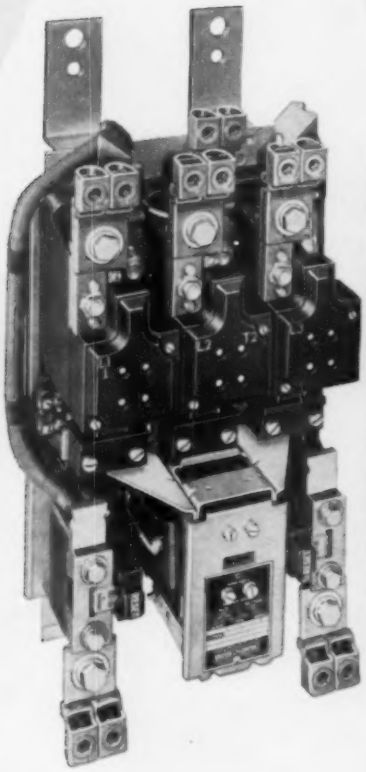
NEW



SQUARE D
Vertical Action
SIZE 5 STARTER

Smaller! REQUIRES ONLY
270 SQUARE INCHES OF SPACE

DESIGN LEADERSHIP FEATURES IN SQUARE D's COMPLETE LINE OF VERTICAL ACTION STARTERS—SIZE 0 through 5

What's most important in a motor starter?

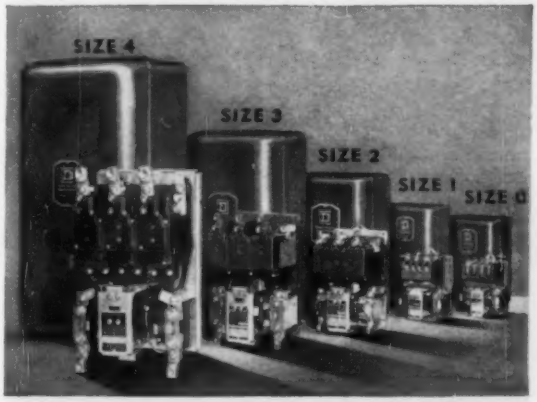
Performance and **long life** come first, naturally—and Square D's straight line guided motion and heavy-duty silver alloy contacts assure both. But that's only the beginning—

Fast wiring is important, too. Square D gives you a lot of wiring space and time-saving solderless terminals.

Easy maintenance rates high. The coils, contacts and overload relays on all Square D starters can be changed in a jiffy... without disturbing external connections. A screwdriver is all you need. And—

"Off-the-Shelf" Parts Kits make normal maintenance and "on-the-job" modifications easier than ever. Packaged parts include interlocks, contacts, coils, overload relays, pushbuttons and selector switches. They're easy to buy, easy to identify and faster to install.

For the complete story, write for Bulletin 8536 Square D Company, 4041 N. Richards St., Milwaukee, 12, Wis.



EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

STONE & WEBSTER
ENGINEERING CORPORATION
DESIGNERS AND CONSTRUCTORS

Neches Power Station, serving the fast-growing Orange-Beaumont, Texas, Industrial and Ship Building Region.

KEY-KAST CARRIES 700,000 P.P.H. STEAM AT NECHES POWER STATION ADDITION

KEY-KAST* Alloy Steel Welding Fittings safely channel main and reheat steam flow from the new 700,000 pounds per hour boiler for the 111,000 kilowatt turbine generator unit at the Neches Power Station of Gulf States Utilities Company.

KEY-KAST Fittings are designed by specialists in fluid flow to give you the most desirable shape and longest lasting steel alloys to move your lading safely and efficiently. Available in all standard shapes, sizes and schedules . . . or especially designed to meet particular conditions of pressure, temperature and lading.

When you need alloy steel welding fittings . . . for new or replacement installation . . . call your KEY-KAST engineer for prompt, experienced service in selecting the KEY-KAST fitting best for you.

For more information about KEY-KAST, write Dept. A-1007 for Bulletin KK 1057

W-K-M
DIVISION OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

KEY-KAST AT NECHES

Purchaser:
Designing Engineers:
Fabricators:
Constructors:
} Stone & Webster Engineering Corporation

PARTIAL LIST OF EQUIPMENT

KEY-KAST 90° Reducing Welding Elbow

Material:	12¾" x 9.3" O.D. 2¼% Chrome, 1% Moly, ASTM A-217 Grade WC9
Temperature:	1000° F.
Pressure:	1695 psig
Service:	Main Steam

KEY-KAST 90° Welding Wye

Material:	18" x 12¾" x 12¾" O.D. 2¼% Chrome, 1% Moly, ASTM A-217 Grade WC9
Temperature:	1000° F.
Pressure:	550 psig
Service:	Reheat Steam

KEY-KAST Concentric Welding Reducer

Material:	10¾" x 9.3" O.D. 2¼% Chrome, 1% Moly, ASTM A-217 Grade WC9
Temperature:	1000° F.
Pressure:	1695 psig
Service:	Main Steam

KEY-KAST 90° Welding Wye

Material:	12¾" x 9.3" x 9.3" O.D. 2¼% Chrome, 1% Moly, ASTM A-217 Grade WC9
Temperature:	1000° F.
Pressure:	1695 psig
Service:	Main Steam

*KEY-KAST is a trademark of acf Industries, Incorporated

5722

MANUFACTURERS OF W-K-M GATE VALVES acf LUBRICATED PLUG VALVES KEY-KAST ALLOY STEEL PIPING FITTINGS KEY RETURN BENDS AND FITTINGS

Refinery men depend on Davison for...

M-S' CRACKING CATALYSTS
Silica-Alumina (13% and 25%)
Silica-Magnesia (experimental)

REFORMING CATALYSTS
Catforming Catalyst—Silica-Alumina-Platinum
Powerforming Catalyst—Alumina-Platinum

DEHYDROGENATION CATALYST
Chromia-Alumina

POLYOLEFIN CATALYST
Chromia-Silica-Alumina

DEHYDRATING AGENT
Silica Gel

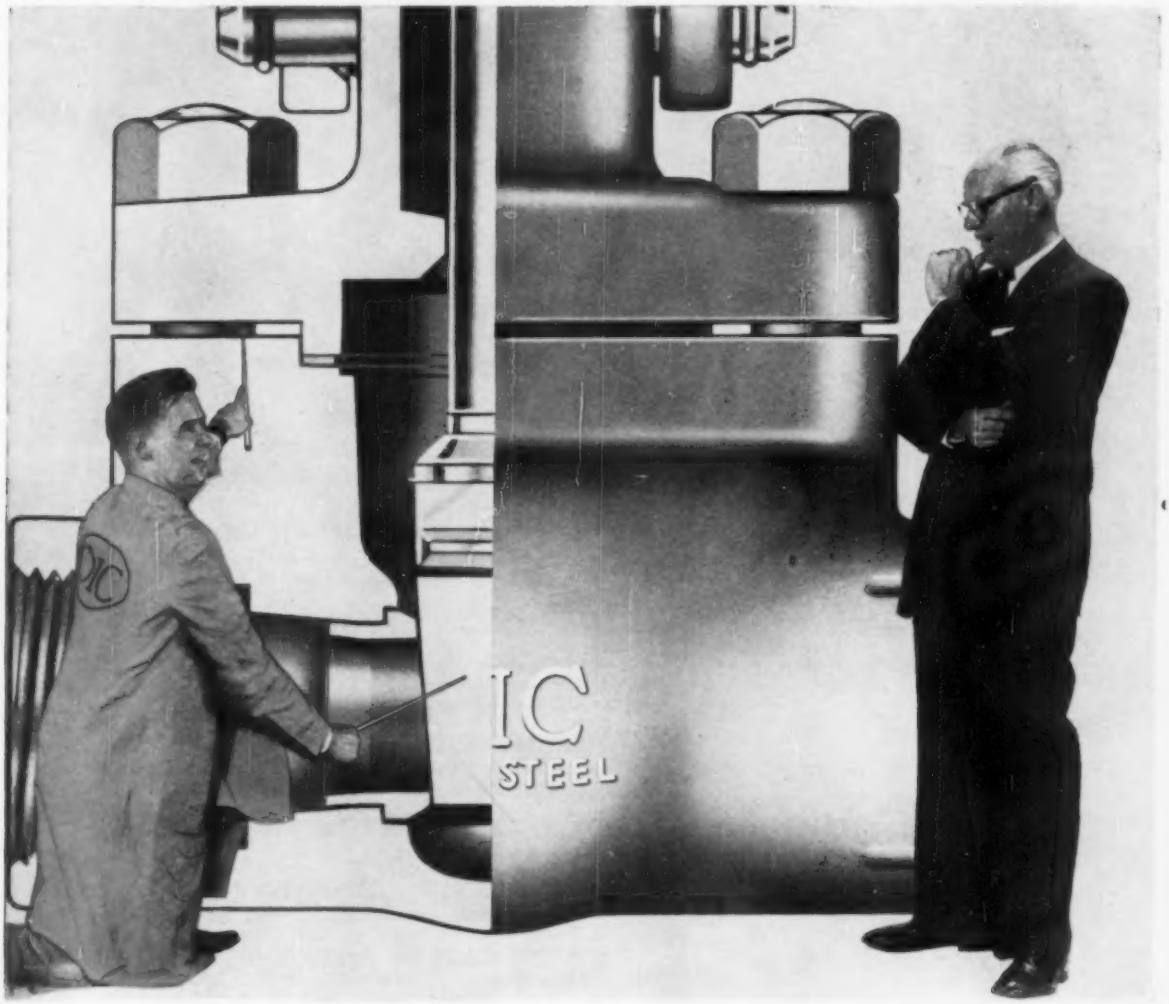
ANTIOXIDANTS
Dav-Ad 101 (alkylated phenol)
Dav-Ad 102 (alkylated phenol in toluene)

Complete laboratory facilities and technical assistance

DAVISON CHEMICAL COMPANY
Division of W. R. Grace & Co.
101 North Charles Street, Baltimore 3, Maryland

SALES OFFICES: Chicago, Ill.; Houston, Tex.; New York, N. Y.; Baltimore, Md.; San Francisco, Calif.; Tulsa, Okla.
In Canada: Davison Chemical Company Ltd., Toronto.

...and you can see here....and here, sir, how we've killed maintenance problems on our new forged steel lines.



We stop galling and erosion by giving you 13% chrome stainless steel trim with wedges *duracased* to a rugged *1000 Brinell hardness.*

The square and *bolted* body-bonnet joint makes it easy to service the valve quicker. And it's a tighter joint, made doubly leakproof by recessing the soft iron gasket into the body. The gasket can't blow!

And you get the fastest joint make-up you've ever seen. Look at those pipe ends. See the extra wrench-gripping area and lugs. See how body-bonnet flanges are out of the wrench's way. No time lost here!

These new 600-lb. OIC forged steel valves are available with either *high-flow* ports (1300 line), or *standard-flow* ports (1100 line). Call your OIC Distributor, or write for specification literature.

The Ohio Injector Company • Wadsworth, Ohio

OIC VALVES | BRONZE, IRON, FORGED AND CAST STEEL, LUBRICATED PLUG VALVES

COMPARE

the deep-down effectiveness of

Adomite®

with other fluid loss control additives

Just how effective is your present fluid loss control additive at bottom hole conditions? As you undoubtedly know, many fracturing additives show desired fluid loss control at surface conditions of low pressure and room temperature. But at bottom hole conditions, fluid loss becomes so high that their effectiveness is lost. Compare them with Adomite. Tests show that, *deep down*, nothing safeguards your profits like Adomite.

What makes the difference?

Adomite, when mixed with oil, disintegrates into millions of tiny particles. These particles seal the face of the formation and keep the fracturing fluid from filtering in. Temporarily sealing the formation, Adomite particles do not plug it.

Other additives, too, contain sealing particles, but these tend to soften or dissolve as temperatures increase. Result: fluid loss control is greatly reduced.

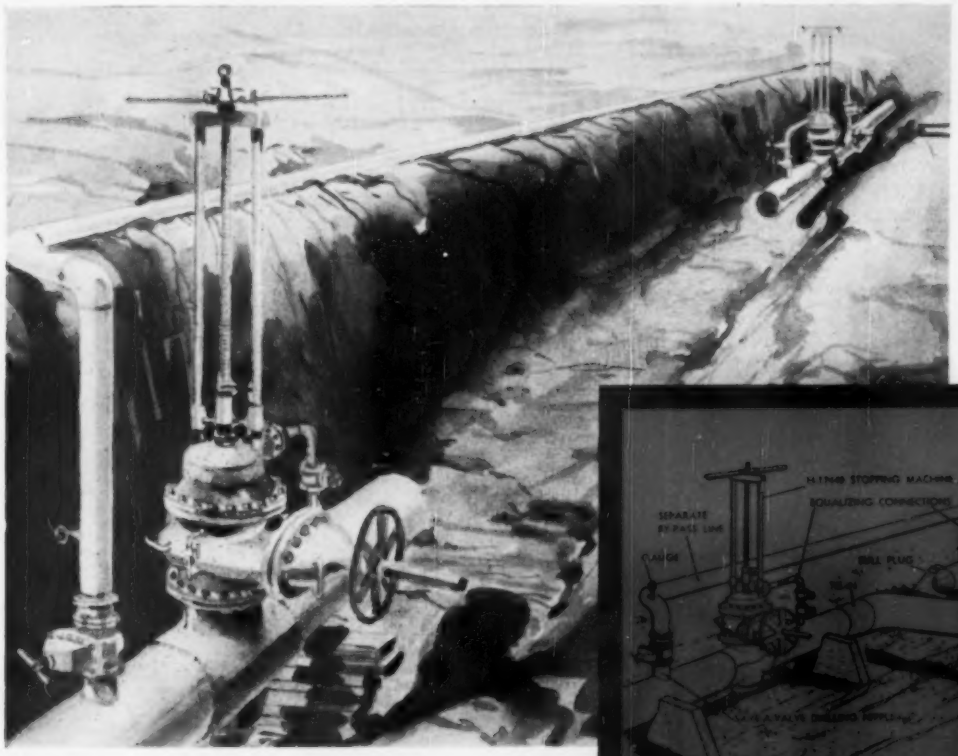
	Fluid Loss at Surface Conditions— 100 psi,* 75°F., cc/30 min.	Fluid Loss at Bottom Hole Conditions— 1000 psi, 150°F., cc/30 min.
ADOMITE + crude oil	2.2	22.0
Additive X + crude oil	37.8	Infinite
Additive Y + crude oil	8.5	Infinite
Additive Z + crude oil	13.0	295 (1 min., 50 sec.)

© 1957, Continental Oil Company

(*Standard API Code 29 Test)

To get best results downhole with straight crude, gelled crude or refined oil, always *specify* Adomite.

FRACTURE WITH ADOMITE



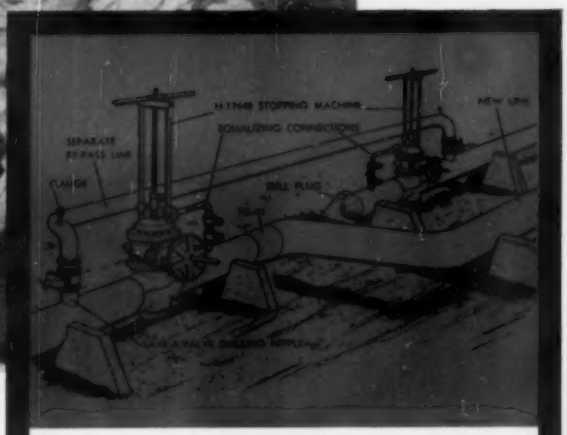
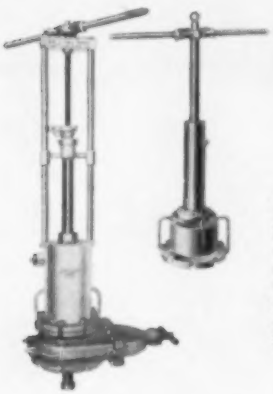


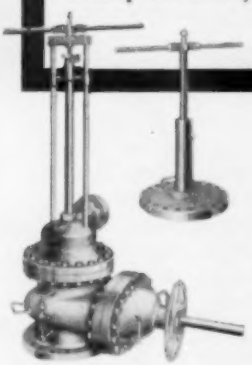
Diagram shows simple set-up used to tie-in larger pipeline to existing pipeline without interrupting service. Two Mueller® Stopping Machines completely isolate a short section of the line while the new line is tied-in. By-pass line carries flow around the isolated section. Operations are performed in complete safety.

Maintain flow while tying-in to 6", 8", 10" or 12" lines under pressures up to 230 p.s.i. at 100°F.



NO-BLO

No. 3 SW Line Stopper Unit, for 6" and 8" lines, with two H-17340 Stopping Machines, one H-17346 Completion Machine and one set of attachments. Maximum pressure: 230 p.s.i. at 100° F.; maximum temperature: 250° F. at 200 p.s.i.



No. 4 SW Line Stopper Unit, for 10" and 12" lines, with two H-17440 Stopping Machines, one H-17445 Completion Machine and one set of attachments. Maximum pressure: 500 p.s.i. at 100° F.; maximum temperature: 250° F. at 375 p.s.i.

Write for information on the complete line of Mueller NO-BLO® products for making tie-ins under pressure.

MUELLER CO. 100 YEAR QUALITY SERVING THE WATER AND GAS INDUSTRIES

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

Since 1857

500-ton traveling block's sheaves take terrific stress—TIMKEN® bearings keep 'em aligned

THE BREWSTER CO., INC., Shreveport, La., assures positive alignment and easy turning of sheaves in this 500-ton traveling block by mounting them on six two-row Timken tapered roller bearings.

SHEAVES in this Brewster 500-ton dead load capacity traveling block are under terrific stress when drilling is under way. There's the weight of the drill string itself, plus stress from action of the spinning pipe. Add to that the stress as the block swings when it raises and lowers the string. To keep the sheaves perfectly aligned, and assure their taking heavy thrust loads as well as turning easily under heavy radial loads, The Brewster Co., Inc., mounts them on Timken® tapered roller bearings.

Because Timken bearings are geometrically designed and precision-made to have true rolling motion, they practically eliminate friction. Sheaves turn easily and smoothly, allowing fast fall of the block—important in speeding up bit changing. What's more, Timken bearings' rollers and races are case-carburized to have hard, wear-resistant surfaces over tough, shock-resistant cores.

Only Timken bearings give you so many advantages. We even make our own steel, to be sure it's the finest. No other U. S. bearing maker takes this extra quality control step.

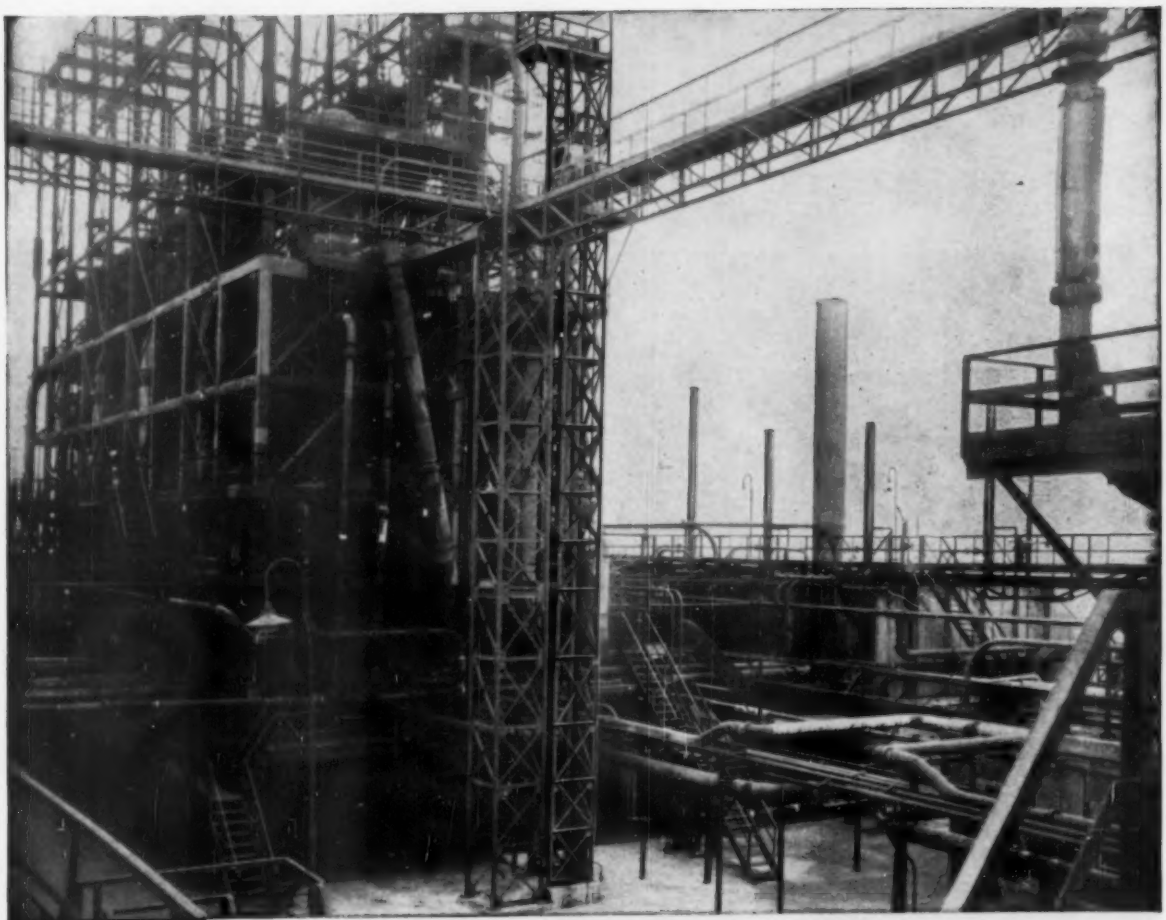
So when you buy or build machinery and equipment, specify Timken bearings to get the most for your money in bearing life and performance. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD



A typical installation of an EHRSAM ELEVATOR at a Gulf Coast refinery.

Safe, Low Cost EHRSAM
ELECTRIC ELEVATOR FOR "CAT" CREWS

FACTS:
Complies with American Standard Safety Code, all state and local codes. Machinery and cab can be furnished galvanized for outdoor installation . . . lift rate, 90 ft. per minute. For special applications, speeds of from 50-120 ft. per minute are available.

SIZES:

2'3" x 2'3"	—	300 lb. capacity (1½ Hp.)
2'9" x 2'9"	—	500 lb. capacity (2 Hp.)
4' x 4'	—	1000 lb. capacity (3 Hp.)
4'6" x 6'	—	2000 lb. capacity (7½ Hp.)

Maximum lift 250 feet. All-metal car with collapsible door. Magnetic brake. Emergency exit and safety door. Rigid, electric-welded all-steel frame.

All components factory assembled and pre-tested for easy installation. Complete operating instructions and detailed drawings included with each unit. Furnished with all elevator safety equipment required by code. All electrical equipment can be furnished explosion proof for either 220 or 440 volts.

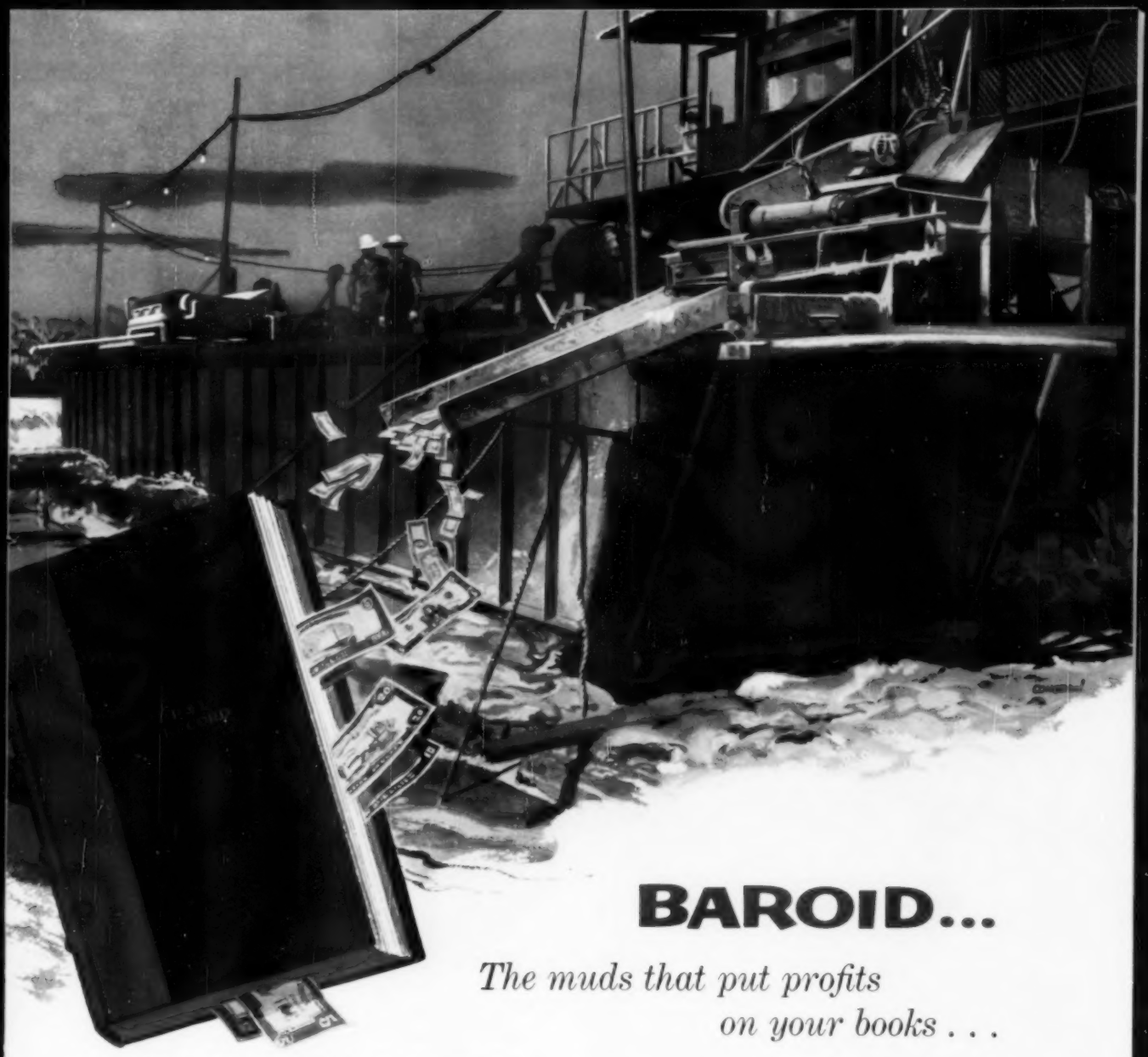
WRITE, WIRE OR PHONE FOR ILLUSTRATED BROCHURE AND LIST OF EHRSAM ELECTRIC ELEVATOR CUSTOMERS.

Push-button, car-type for 1 to 6 passengers.
Easy to run, inexpensive to operate, simple to install.

EHRSAM

THE J. B. EHRSAM & SONS MFG. CO.
DEPT. OG, ENTERPRISE, KANSAS
"OVER 80 YEARS OF DEPENDABLE SERVICE"

SALES OFFICES: Denver, Colorado; Fort Worth, Texas; Kansas City, Kansas.
WEST COAST: Ehrsam Pacific, Inc., Riverside, California.



BAROID...

The muds that put profits on your books . . .

. . . How? By reducing costs through new and better products, services and techniques.

No single item of drilling expense can be as important to profits as the muds you use and Baroid muds *make equipment work better;* Baroid muds *reduce down time;* Baroid muds *make better completions.* And all the while Baroid muds get effective penetration at more economical mud costs.

Every Baroid engineer, production man and research technologist knows that a better mud that will reduce your costs will make more profits for you and make a better customer for Baroid.

Get Baroid on the job . . . and profits on your books!

When you buy Baroid -- you buy the Best!

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Main Office: P. O. Box 1675, Houston 1, Texas

5788

New From Baroid

DOUBLE-BARRELED MUD SYSTEM PROTECTS ZONES, DRILLS DEEPER

Drill faster and deeper with these new DMS and DME brand mud chemicals. Use them with or without emulsified oil for a "surfactant mud" system that is attracting wide engineering interest.

DMS & DME brand additives produce a mud that keeps fluid out of cuttings and formations, provides more efficient removal and recovery of cuttings, and resists high temperatures at great depths. Write for engineering report.

*A trademark of Magnolia Petroleum Company

When you buy Baroid—you buy the Best!

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Please send me your bulletin on DMS & DME.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

- Less solids build-up in mud
- Minimizes formation damage
- Easy to run and cement casing
- Permits use of inhibited mud with low resistivity
- Inhibits hydration and dispersion
- Holes remain close to gauge
- Not affected by salt waters
- Stable to high bottom-hole temperatures
- Bits and drill pipe last longer

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Engineering Progress Report
FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE'S diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

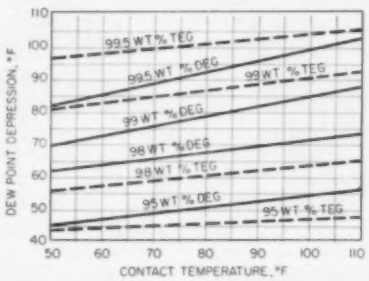
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE'S extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE'S Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE'S glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation

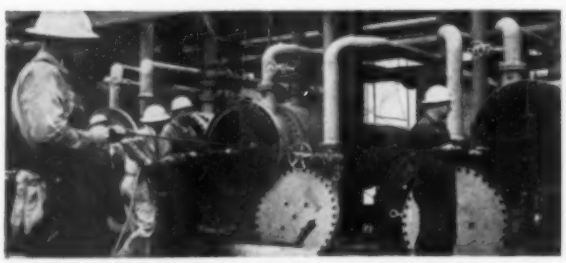
UNION CARBIDE
CHEMICALS
Union Carbide Chemicals Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

Condenser efficiency can be materially increased by removing deposits accumulated in operation. Metal can be protected by using ACP Rodine to inhibit acid solvents in cleaning.

ACP Rodine® INHIBITS THE ACID SOLVENTS USED IN THE CLEANING OF INDUSTRIAL EQUIPMENT, TANKS AND PIPING SYSTEMS

Make sure that your equipment is protected against acid attack during cleaning—specify ACP Rodine for inhibiting the acid solvents used to dissolve and disintegrate the troublesome deposits which reduce the efficiency of boilers, heat exchangers, cooling systems, condensers, etc. ACP Rodine is water soluble, liquid foaming—a strong inhibitor and a strong detergent. It provides an excellent safeguard with most acid solvents used in industrial cleaning operations. Rodine can be advantageously applied in any type of carbon or low-alloy steel equipment.

Write for complete information today. And remember our technical sales engineers will be glad to discuss your problems with you, and make specific recommendations.



Manual cleaning operations—like the one shown above—require more labor, take more time, are much less effective than chemical cleaning with ACP Rodine-inhibited solvents.

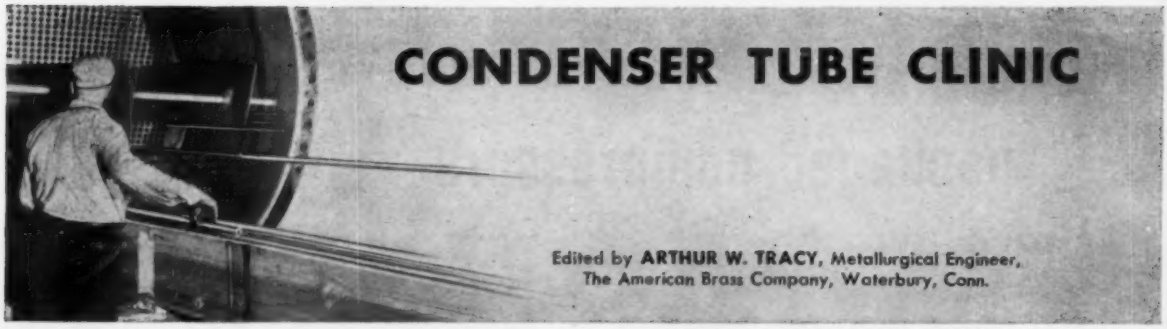
ACP Rodine is also used to inhibit corrosion in sweet wells, condensate wells, and secondary recovery operations. It's economical, too, costs only pennies a day.

AMERICAN CHEMICAL PAINT COMPANY, Ambler 39, Pa.

CHEMICALS ACP PROCESSES

DETROIT, MICH. • ST. JOSEPH, MO. • NILES, CALIF. • WINDSOR, ONT.

New Chemical Horizons for Industry and Agriculture



CONDENSER TUBE CLINIC

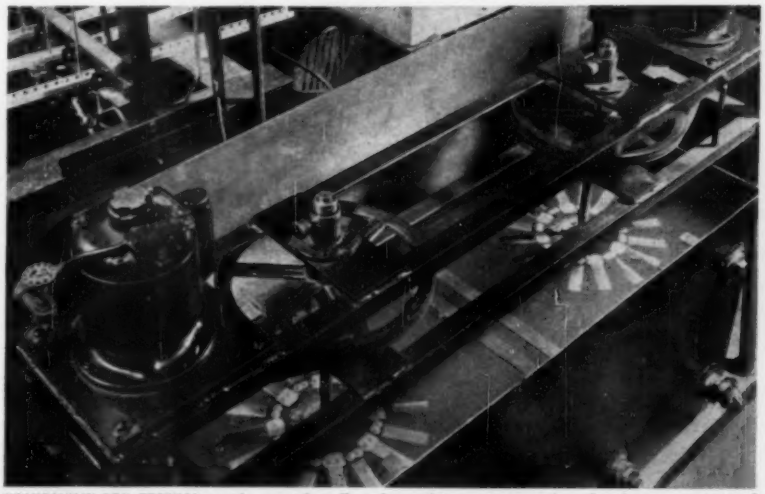
Edited by **ARTHUR W. TRACY**, Metallurgical Engineer,
The American Brass Company, Waterbury, Conn.

Some Operating Factors that affect tube life

OXYGEN AND AIR

Oxygen in the air in cooling waters is a necessary factor for corrosion to occur, but normally the presence of oxygen in solution does not cause rapid corrosion of condenser tubes. On the other hand, air in the form of bubbles can cause rapid corrosion of condenser tubes under conditions where turbulent flow is present. Air bubbles of harmful size may be produced by whirlpools in the intake tunnel, leaky packing glands on pumps, and at projections in injection pipes or water boxes. Any condition that will produce a negative pressure at some point along a tube, such as a long outlet water leg from a condenser, can also cause air bubbles to form with consequent local rapid pitting.

Sea-chest strainers may be another source of air bubbles unless designed to allow nonturbulent flow of water.



EQUIPMENT FOR TESTING condenser tube alloys for resistance to corrosion. Specimens are rotated under water to determine the effect of velocity. Further information is obtained by testing actual condenser tubes in operating condensers.

STRESSES

Stresses capable of causing stress-corrosion cracking of some alloys can be set up in tubes by thermal expansion pressure or from the rolling-in of tubes into tube sheet. It is not usually possible to change operating conditions to reduce stresses, but failures from stress-corrosion cracking can be minimized by the careful rolling-in of tubes to avoid developing high longitudinal stresses, especially when both ends of the tubes are expanded into the tube sheets.

Cyclic stresses due to vibration can cause fatigue failure of condenser tubes, and such a failure can be extremely rapid even when only tiny corrosion pits have developed on the wall of the tube. If the source of the vibration cannot be removed, the vibration of the tubes can sometimes be dampened.

GALVANIC EFFECTS

The galvanic corrosion of condenser tubes is seldom a problem because the choice of metals is usually such that the tubes are galvanically positive (cathodic) to the tube sheets and the water boxes. Any slight galvanic corrosion on tube sheets and water boxes due to their being anodic to the tubes is insignificant because of their relatively great thickness.

Zinc or magnesium sacrificial anodes are frequently placed in condenser water boxes that have been treated with paint or an organic coating to protect the iron or steel from accelerated corrosion at "holidays" or pinholes in the coating. Such anodes will generally protect the ends of the tubes from corrosion for a short distance, usually equivalent to about two tube diameters.

There is considerable experience indicating that bare iron or steel water boxes not only act as sacrificial anodes in protecting the ends of condenser tubes, but also that the corrosion products from these water boxes mixing with the tube corrosion products help build a more protective film along the whole length of the tube. Iron anodes in painted water boxes will be a source of iron compounds but will have little effect in galvanically protecting water boxes at the discontinuities in the paint film. When a new set of tubes is started in service in an old condenser where surfaces are well scaled, the use of new, clean iron anodes should aid in a more rapid formation of protective film on the tubes.

TECHNICAL HELP IN SELECTING TUBES

Your situation may require special consideration and analysis. We are always ready to help and advise in the selection of the right alloy to give best service. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8787

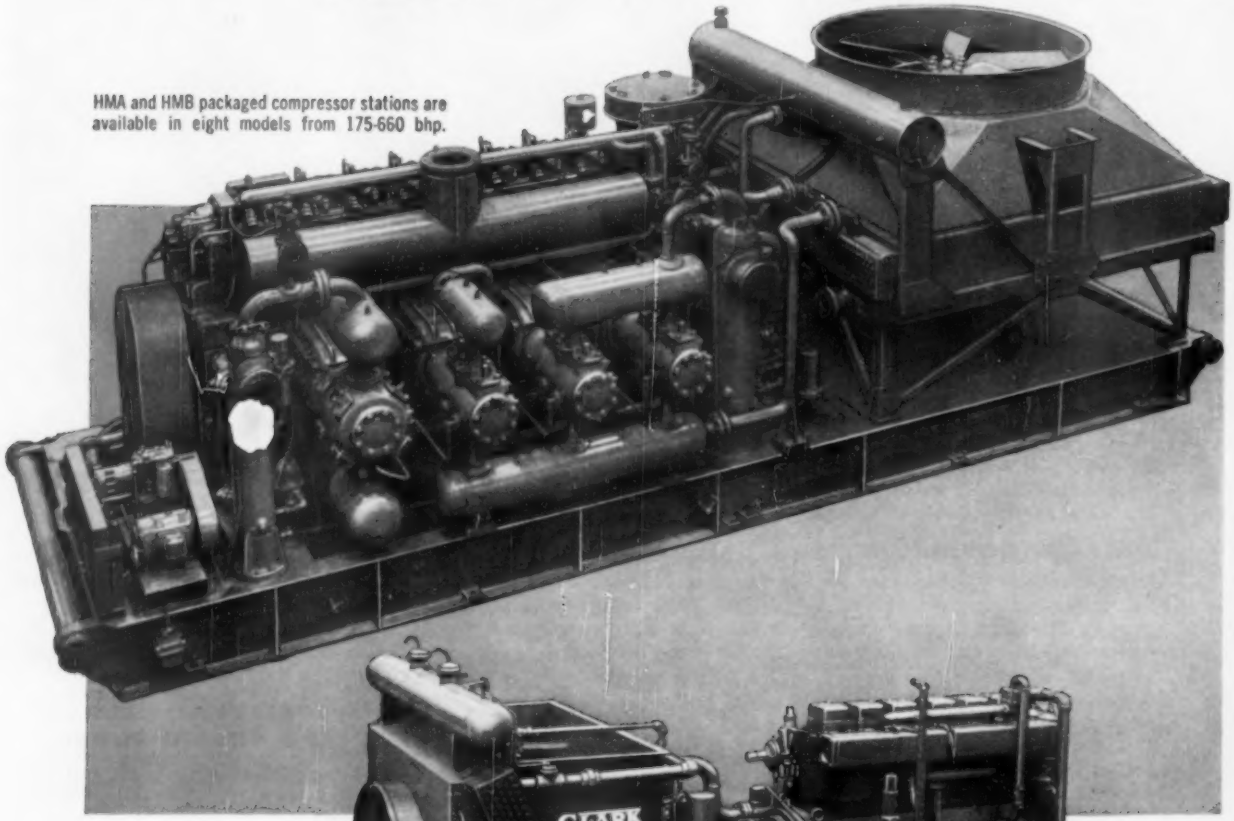
ANACONDA®

TUBES AND PLATES

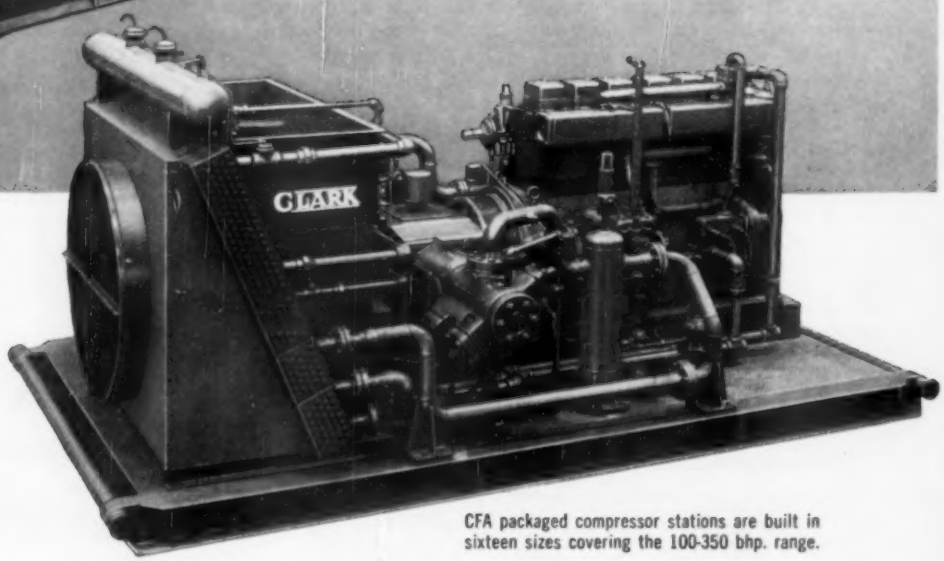
for Condensers and Heat Exchangers

Made by **THE AMERICAN BRASS COMPANY**

With Clark packaged compressors there are 24 SIZES TO .....



HMA and HMB packaged compressor stations are available in eight models from 175-660 bhp.



CFA packaged compressor stations are built in sixteen sizes covering the 100-350 bhp. range.

CHOOSE FROM!

Excess horsepower in a field compressor, above and beyond its inherent overload carrying ability, is fine if you have a use for it. But when it is horsepower that can't be made to earn its way, it's money down the hole.

With twenty-four sizes to choose from, Clark can deliver a packaged compressor that's tailored exactly to your horsepower needs in the 100-660 bhp. range. You can realize substantial savings by avoiding the installation of an improperly sized unit just because "it's all that's available".

When you need flexibility, Clark can give you that also. Every Clark field compressor has a maximum number of compressor cylinders. With many units, you can work two sands simultaneously or, if you have to move a unit to a new field, radically different operating conditions can be handled with a minimum of change-over.

Clark CFA, HMA and HMB packaged field compressors are proved machines. They are the only field compressors available that have been specifically designed for the job. Their balanced/opposed design eliminates the need for massive foundations . . . just enough to level them is ample.

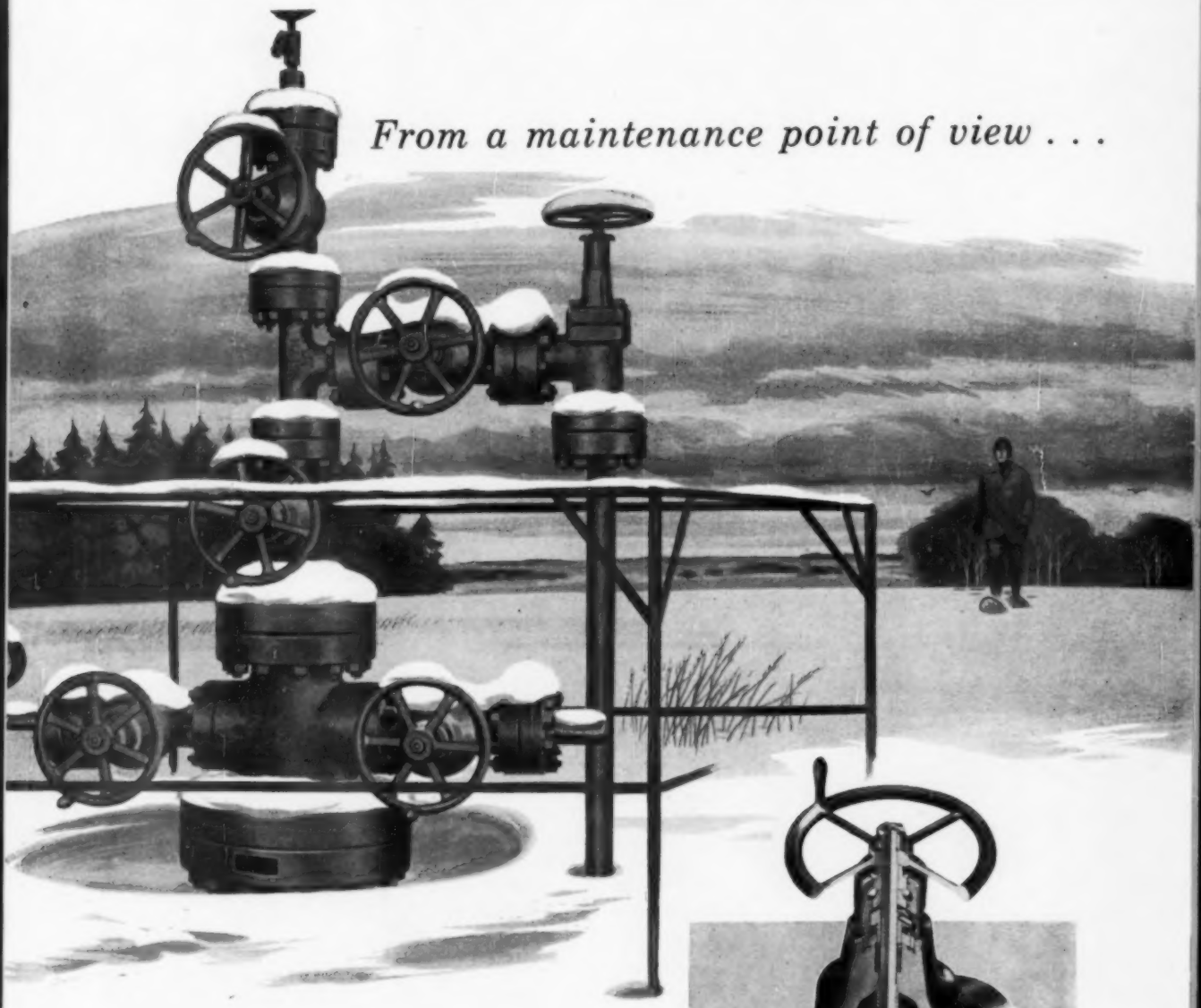
Your nearest Clark office has a specialist on field compressors. Call him . . . he will be pleased to give you all the facts and figures.

CLARK BROS. CO. **OLEAN, NEW YORK**
One of the Dresser Industries
Offices in Principal Cities Throughout the World

CLARK®

Packaged Compressor Stations

From a maintenance point of view . . .



BIW non-lubricated gate valves

Whether your locations are this remote or not, you can reduce maintenance costs and increase your operating efficiency with BIW Valves. Because once they are in, you can forget them. You waste no man-hours lubricating them. The tight metal-to-metal seal and the simplified design of the valve have been proved in years of trouble-free service.

The BIW gate valve is truly easy to open or close under pressure. For instance, the 10,000 lb. test, 2½ in. valve requires only 25 foot-pounds of torque against a pressure of 5,000 psi. Plus, when you close it, you know that it will hold. More than 35,000 BIW Valves in the field are holding now, and will be working smoothly, effectively and with no fuss years from now.

ALCO specialists are available to consult with you. Write or call Petroleum Industry Equipment Division, Department BV-2, Bank of the Southwest Building, Houston 2, Texas.

ALCO

ALCO PRODUCTS, INC.

NEW YORK

Sales Offices in Principal Cities

"Those Galvomag anodes give us the added punch we need for our high-resistivity soil"

If you've got an underground corrosion problem, Galvomag® magnesium anodes are almost always the best solution.

Galvomag, the Dow high-potential anode that delivers 25% more current than conventional anodes, gives continuous protection to underground equipment—and it's easy on your maintenance budget. These more powerful anodes also provide extra punch and throwing power in high-resistivity soils. In normal soils they insure against corrosion with fewer anode units. Either way, you save on your original investment for cathodic protection.

Contact one of the Dow magnesium anode distributors listed below for detailed information and technical assistance, or write directly to us. THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1428HH-3.

Call the distributor nearest you: **Cathodic Protection Service, Houston, Texas • Corrosion Services, Inc., Tulsa, Oklahoma • Electro Rust-Proofing Corp. (Service Division), Belleville, N. J. • Ets-Hokin & Galvan, San Francisco, Calif. • The Harco Corp., Cleveland, Ohio • Royston Laboratories, Inc., Blawnox, Penna. • Stuart Steel Protection Corp., Plainfield, N. J. • The Vanode Co., Pasadena, Calif.**

YOU CAN DEPEND ON DOW

News on Ethylene from England

Imperial Chemical Industries Ltd., the largest chemical manufacturing firm in the British Commonwealth, is meeting the increased demands for ethylene-derived products with a third ethylene manufacturing plant in northeast England. As the discoverer and a major producer of polyethylene, I.C.I. consumes large amounts of high purity ethylene.

The M. W. Kellogg organization was privileged to engineer I.C.I.'s first two ethylene plants. Kellogg is completing the engineering of the third plant, and has started construction. All three plants utilize the unique Kellogg steam-cracking process which produces exceptionally high yields of over 99% pure ethylene with a high on-stream efficiency.

The close cooperation and interchange of technology between I.C.I. and Kellogg will assure the success of this new plant as it did for the two now in operation. Kellogg's ability to work closely and harmoniously with chemical companies is largely responsible for the organization's leading international position in petrochemical engineering.

The M. W. Kellogg Company welcomes your petrochemical inquiries.

M KELLOGG W

CHEMICAL PROCESS DIVISION

THE M. W. KELLOGG COMPANY

711 THIRD AVENUE, NEW YORK 17, N. Y.

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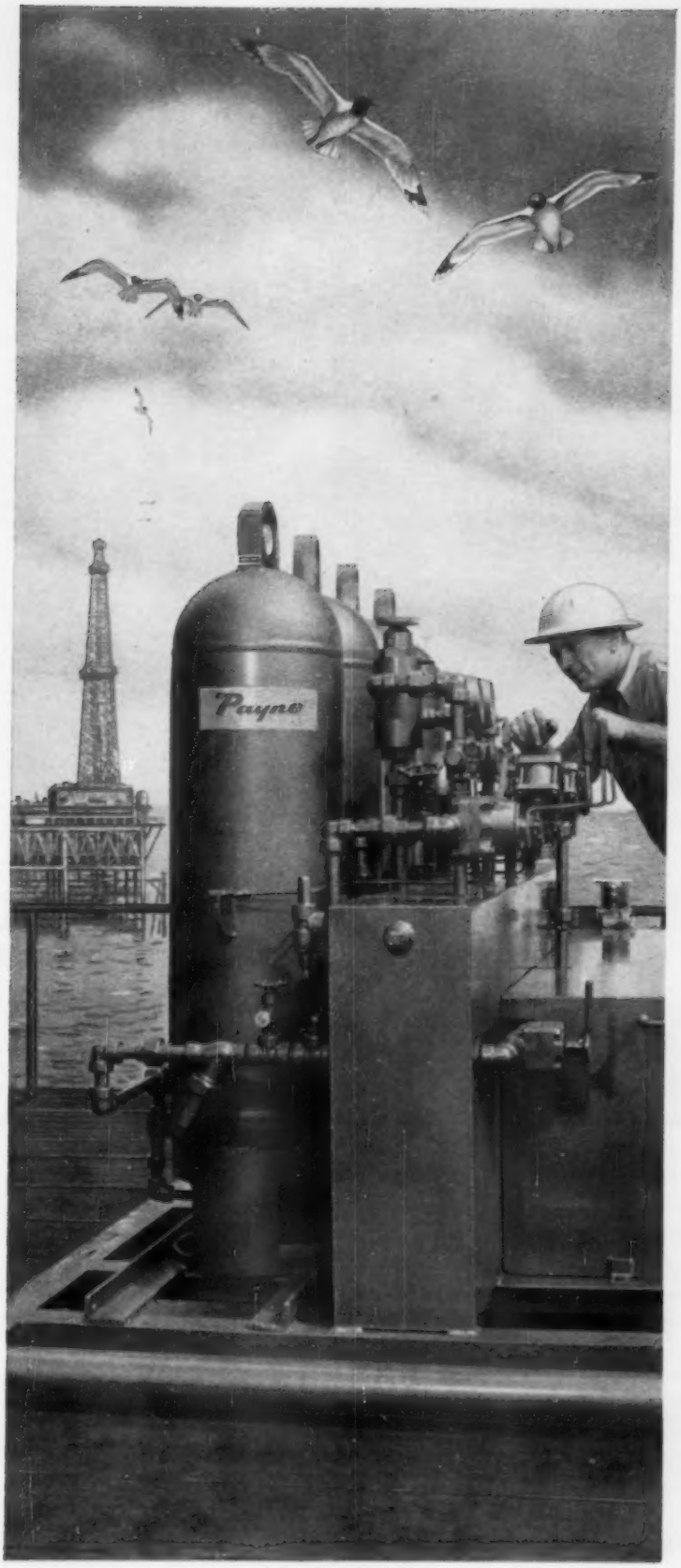

PAYNE PROTECTION

ON MORE NEW OFFSHORE RIGS

An ever-increasing number of offshore drilling companies are choosing rugged Payne Blowout Preventer Operating Units for their new rigs. Our list of customers includes:

An-Son Gulf Drilling Company

Barnwell Drilling Company, Inc.

Deepwater Exploration Company

Dixilyn Drilling Corporation

C. G. Glasscock Drilling Company

Penrod Drilling Company

Where extra protection is essential, Payne units get the job done. This, of course, is because they are designed especially to meet today's tough requirements. Payne Pumps are big and fast-acting, produce volume and pressure promptly. Maintenance is very low because they have so few parts. Payne patented Non-Separator Accumulators have no diaphragms or bladders to cause expensive shutdowns. They are assembled in multiple units for any volume, maintain a big 2,000 psi reserve for the safest protection available. We are happy to say that more drilling people every month throughout the oil producing areas of the free world are choosing the reliability and sound economy of Payne Blowout Preventer Operating Units.

Payne

MANUFACTURING COMPANY INC.

P. O. Box 9278 Houston, Texas
Phone: WA 1-7379 • WA 1-2021 •
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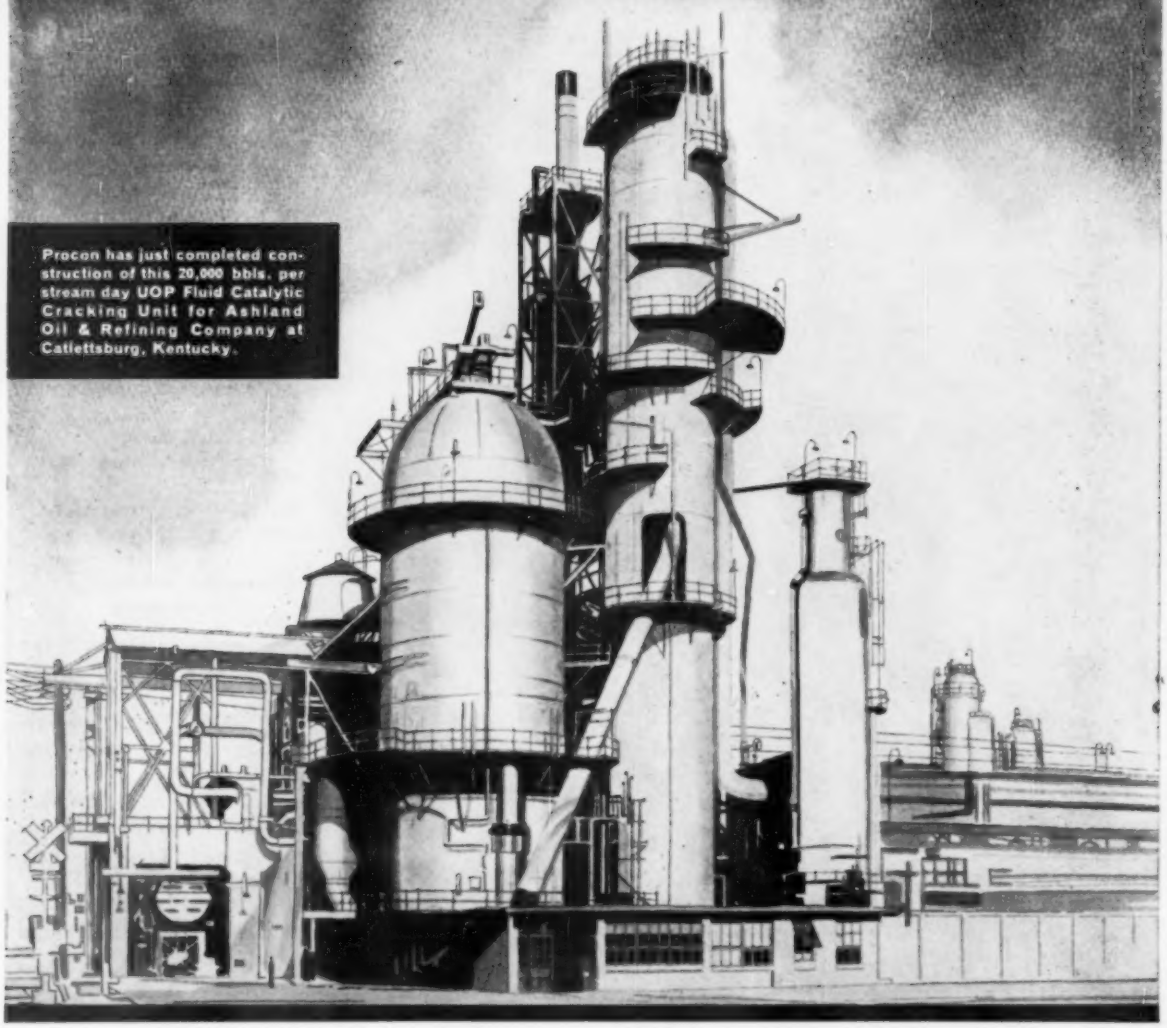
Export: R. S. Stokvis & Sons, 17 Battery Place, New York 4, New York

True satisfaction in building comes only with the finished job



Procon has just completed construction of this 20,000 bbls. per stream day UOP Fluid Catalytic Cracking Unit for Ashland Oil & Refining Company at Catlettsburg, Kentucky.

Here at Procon we take a lot of satisfaction in all phases of our work as builders. Everything we do, from designing and engineering through each stage of construction, gives us that feeling of accomplishment which is so rewarding a part of any job well done.

We only get our fullest measure of satisfaction, though, when the job is finished, faithfully done to every requirement of specification and time.

Procon's experienced organization plans and builds refineries, petrochemical and chemical plants anywhere in the free world. You can count on any project you trust to Procon being completed to your true measure of satisfaction, too.

PROCON *Incorporated*

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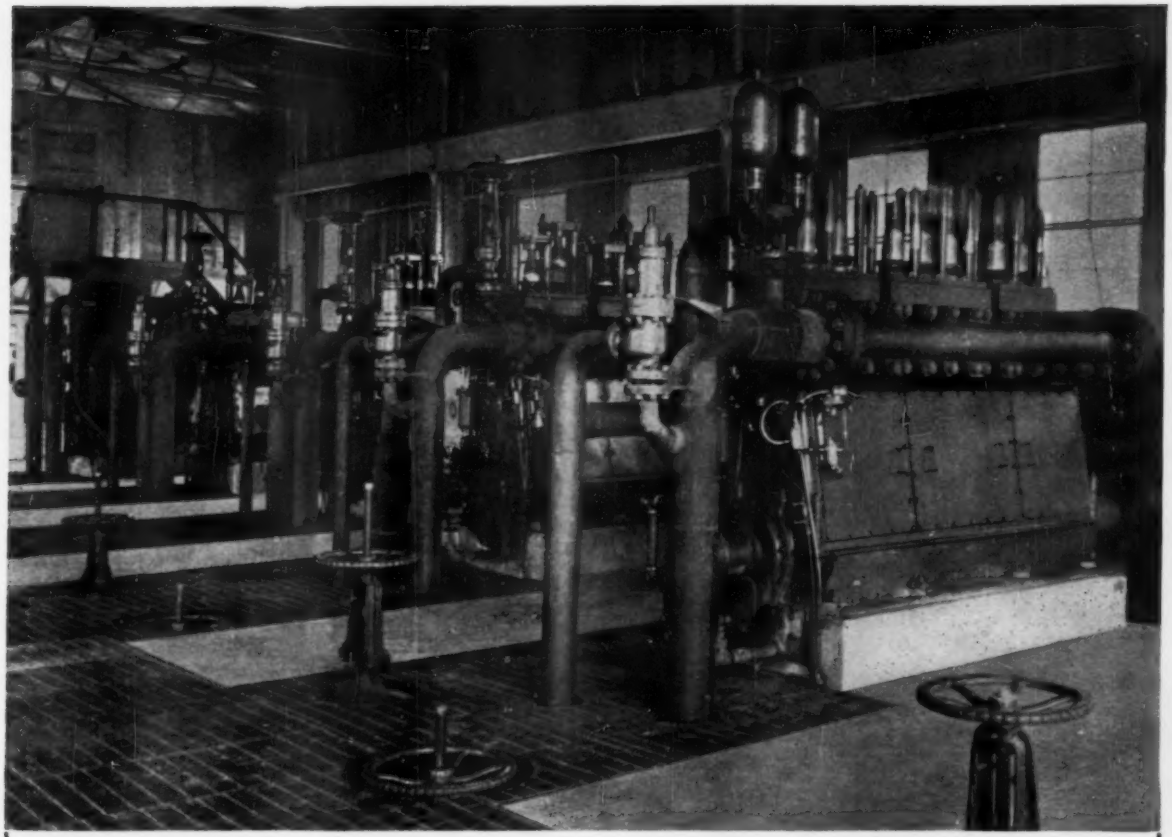
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL AND CHEMICAL INDUSTRIES



FIELD REPORT

FLOOD: Salem Unit

PUMPS: 10 Aldrich Pumps

2 Variable Stroke, 2 Triplex, 2 Quintuplex, 4 Septuplex

FLOODING STARTED: April 1953

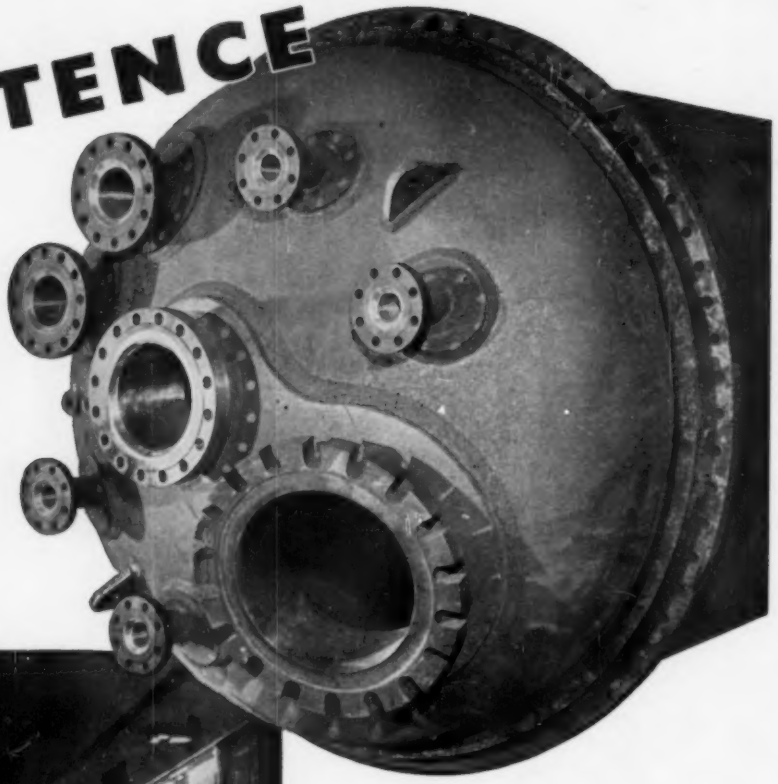
EXPERIENCE TO DATE:

Pumps operating currently under 800 lb pressure, delivering 171,000 bbl a day. Handle mixture of fresh water and oil field brine. Routine maintenance every 4000 hours. Customer reports pump operation and Aldrich field service "satisfactory."

Field parts stock available in Carmi, Ill.; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

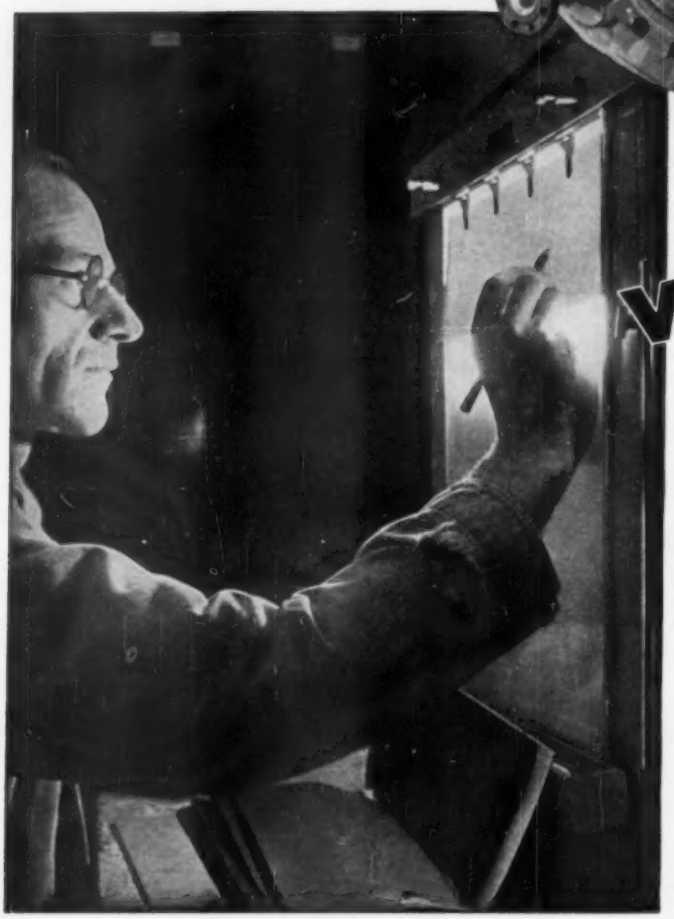
the toughest pumping problems go to ALDRICH

COMPETENCE



Head of a 6 ft. dia. Autoclave spun on the Harvey "Rotarpress" from a stainless steel disc 1⅝ in. thick.

Designed for a working pressure of 500 lbs./sq. in.



VIGILANCE

KEYNOTES OF

Harvey

FABRICATION

G. A. HARVEY & CO. (LONDON) LTD., Woolwich Road, London, S.E.7 England. Cables: 'Cheaper, London'

By Max Ready—Dale Ledbetter
Johnston Testers

FOR MORE INFORMATION ON YOUR DRILL STEM TEST

A check-off list for reverse circulating drill stem tests

PART II

REVERSE CIRCULATION ON GULF COAST (CASING TEST)

Deep tests and high pressures found in the Gulf Coast (Louisiana and Texas) call for more precise reverse circulating procedures on casing tests. Surface pressures above 7500 psi have been encountered and wells below 15,000 ft. have been successfully tested and the recovered fluid reversed out.

While cased holes supply ideal reversing conditions by covering possible sloughing formations and allowing application of pressure in the annulus to speed the reversing process, the high formation pressures must be carefully guarded to prevent blow-outs. Both flow and reversing from these high pressure formations are controlled by 10,000 to 15,000 psi test flow heads.

The Type A Reversing Sub, Type B Reversing Sub and Shut-In Reversing Valves may be used equally well on casing tests. The shut-in reversing valve can be operated to take formation shut-in pressure and provide ports for reversing. These operations can be done separately or simultaneously—at the discretion of the oil company representative.

The practice of reversing from "bottom" and the "simultaneous" operation of the SIR valve is widely used.

Reversing sub or valve locations are dependent on the amount of "sample" to be left in the pipe. The "sample" attains even greater importance in cased holes because a small amount of salt water may indicate a cement "channel" job, which, if unnoticed, might lead to a work-over at a later date.

The SIR Valve can be operated without bleeding down the tubing or drill pipe pressure—an added feature which helps prevent tubing or drill pipe collapse.

If packer remains seated during reversing, pressure applied to the casing annulus will be blocked from the perforations tested.

The speed of reversing can be controlled by regulating the valves on the surface flow manifold and the pressure applied to the mud in the annulus below the closed rams or "Hydril."

By closely checking the weight (pounds per gallon or pounds per cubic foot) of the fluid being reversed out, a minimum of expensive drilling mud will be wasted. Normally reversing will be complete when clean mud of normal pit weight appears at the surface.

Reverse circulation check off list

Before operating reversing valve
- ☐ Pump running
- ☐ Mud line valves positioned to divert mud flow to annulus
- ☐ Rams and/or Hydril checked for operation

Operating Reversing Valve (Type A and/or Type B)
- ☐ Close well in at surface
- ☐ Disconnect high pressure steel flow hose
- ☐ Close shut-in tool by rotating
- ☐ Reconnect high pressure steel flow hose
- ☐ Bleed down drill pipe (if go-devil hanger not used)
- ☐ Check mud in annulus (*must stay full* throughout reversing operation). Packer may be pulled loose if shut-in period is completed.
- ☐ Drop proper go-devil to operate reversing sub
- ☐ Close surface valve (keep closed as long as annulus is *not* full)
- ☐ Control flow of recovery with surface valves so that hole remains full of mud.

Operating Shut-In Reversing Valve
- ☐ Close well in at surface
- ☐ Disconnect high pressure steel flow hose
- ☐ Check mud in annulus (must stay full during shut-in and reversing procedure)
- ☐ Rotate to close SIR Valve for shut-in (if valve is "blanked-off" reversing may be started by further rotation, 11 rounds only—if valve is not "blanked-off," do not rotate into reversing position)
- ☐ Rotate SIR Valve into reversing position (total of 11 rounds)
- ☐ Reconnect steel flow hose
- ☐ Keep surface valve closed as long as annulus is not full of mud
- ☐ Control flow of recovery with surface valves so that hole remains full of mud

NOTE: If reversing stops, apply moderate pressure to annulus or apply moderate pressure to tubing or drill pipe until normal circulation is barely established then go back to reverse circulation.

When natural reversing is completed or to speed reversing procedure
- ☐ Close rams or Hydril
- ☐ Apply moderate pump pressure to annulus
- ☐ Stop pumps when clean mud of normal weight is reversed
- ☐ Remove flow head and come out of hole at proper speed (prevent swabbing). Pipe should pull dry.

This is the second article on Reverse Circulating drill stem tests. The first article covered reverse circulation in the Permian Basin.

For complete information on Reverse Circulation write Johnston Testers, Houston, Texas.

DALE LEDBETTER
Dist. Mgr.
Houston, Texas

MAX READY
Area Mgr.
Louisiana Gulf Coast

Type B Reverse Circulating Sub

Type A Reverse Circulating Sub

Shut-in Reversing Valve

JOHNSTON TESTERS

A Subsidiary of Schlumberger Well Surveying Corporation

first in drill stem testing

HOUSTON, TEXAS

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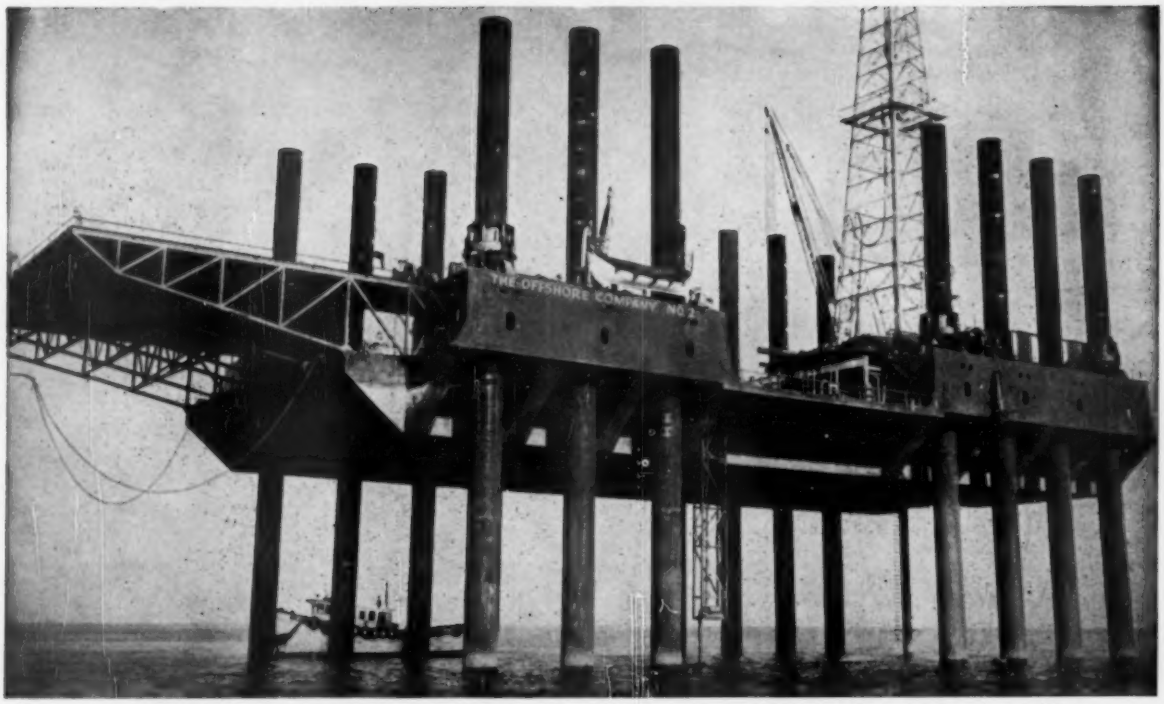
FORMATION AND CASING TESTING — JOHNSTON



OFFSHORE COMPANY'S MOBILE RIG 52 on location 45 miles southeast of Cameron, La. The Queen of the Offshore fleet is operating here in 58 feet of water, with a planned hole depth of about 9,000 feet.

EXCEPTIONAL COMMUNICATION NEEDS OF OFFSHORE COMPANY MET BY GENERAL ELECTRIC KNOWHOW

To obtain dependable two-way radio communication with its rigs and cars throughout the Louisiana Gulf Coast from headquarters in Baton Rouge, the Offshore Company needed more than a normal two-way radio system. General Electric engineers solved Offshore's communication problem of extra-long distances between mobile locations by designing the Offshore radio system around a centrally located base station remotely controlled from Baton Rouge, La.

Offshore's main transmitter, a 250-watt G-E unit, is located 40 miles south of Baton Rouge with its antenna atop a 450-foot tower. This base station, remotely controlled from Offshore's Baton Rouge headquarters by means of a 450-megacycle relay link, has the effect of doubling Offshore's radio coverage to the south.

SELECTIVE PAGING

Another unique feature of Offshore's General Electric radio system is electronic selective paging. This allows the Baton Rouge dispatcher to sound a buzzer on the desired offshore or inland rig when no one answers his call. The buzzer, which can be heard throughout the rig, greatly increases the speed with which radio messages get through to the person sought.

The equipment operated by Offshore includes 250-watt General Electric two-way radio stations on 15 rigs and 60-watt units in 13 company cars. The company reports excellent ranges and dependability from all its radio units...over land *and* over water.

General Electric communication engineers can solve your communication problems with a well-planned radio system, utilizing the finest two-way radio made—the Progress Line. Such exclusive standard features as 6600-series communication-type tubes and controlled reluctance microphones, plug-in versatility, and low-cost maintenance based on a nationwide network of authorized service stations make the Progress Line your best assurance of dependable mobile communications.

Call in the General Electric communication experts; let them show you how well a Progress Line radio system will fit your specific needs.

FOR SALES AND SERVICE see "Radio Communication Equipment" in your Yellow Pages. Or, write: General Electric Company, Communication Products Department, 18107-7, Electronics Park, Syracuse, New York. *In Canada, write:* C.G.E. Electronics, 830 Lansdowne Avenue, Toronto.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Natural Gas Pipeline Company of America Finds GAS LINE LIKE NEW AFTER 27 YEARS!

Bitumastic coal-tar enameled pipe to be re-used

In relocating its line to make way for a new highway near Truro, Iowa, the Natural Gas Pipeline Company of America removed some 900 feet of Bitumastic® enameled pipe laid in 1930. According to Mr. D. C. Allen, District Superintendent, this 24-inch seamless steel tubing is in such good condition that it will be reconditioned and used again as new pipe.

Applied by the rolling and "granny-rag" method in 1930, the Bitumastic XXH Enamel on this line was in excellent condition. The asbestos-felt overwrap, originally applied loose, was torn from soil stresses, but the Bitumastic enamel coating showed no serious disbonding or deterioration. At the time of relocation, the section had been under cathodic protection for two years. Natural Gas Pipeline Company of America records show no corrosion leaks on this section during the entire 27-year period underground.

Case histories such as this from prominent pipeline companies prove the unmatched protective ability of coal-tar enamel. In these days of rising material costs, you can't afford to gamble your entire pipeline investment on a less effective coating.

Your Koppers representative will be glad to give you full information on the superior protection of Bitumastic coal-tar enamels. Koppers District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh, and Woodward (Birmingham), Alabama.

104K

KOPPERS

BITUMASTIC
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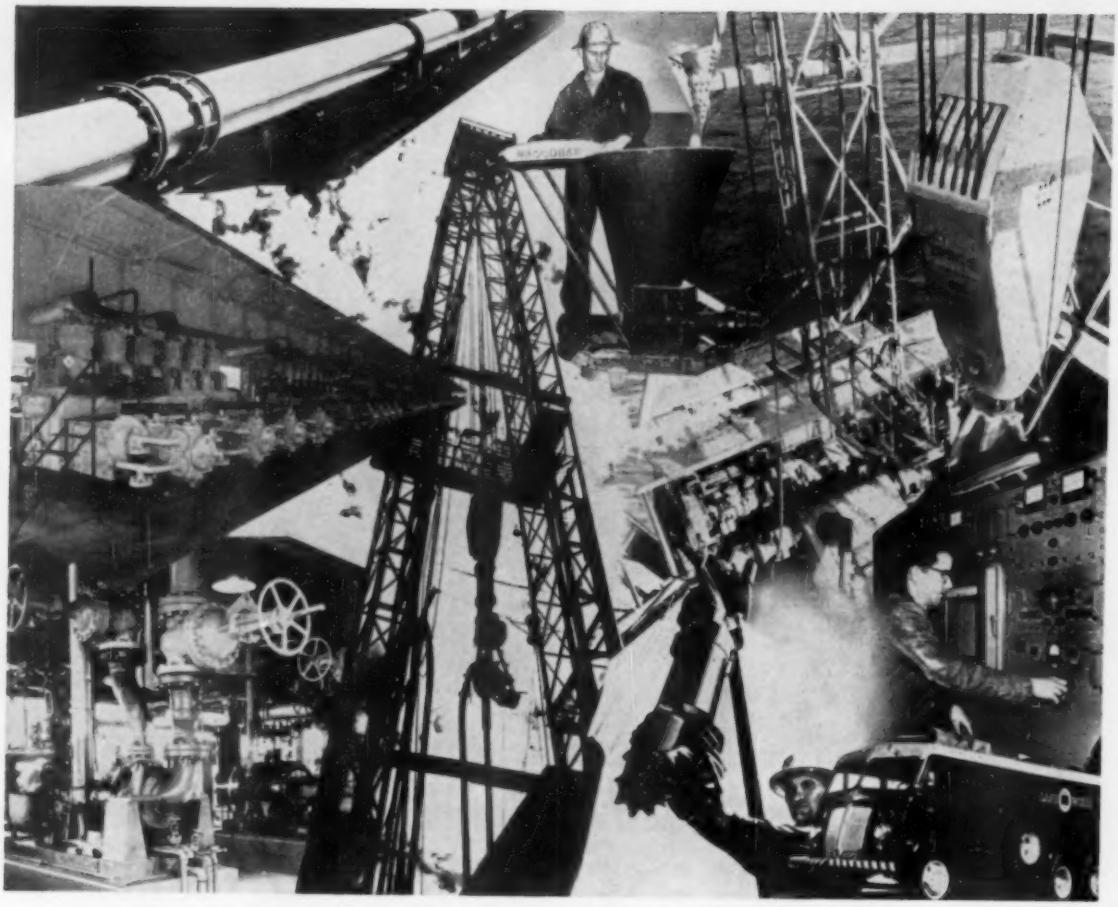
PROTECTIVE COATINGS



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Baker Hotel
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Dallas, Texas
October 6-9

DRESSER salutes the members of the Society of Petroleum Engineers for their many contributions to the progress of our oil and gas industries.

THE DRESSER INDUSTRIAL TEAM SERVES THE GROWING OIL

the Dresser Badges of Merit plus+

CLARK

CLARK BROS. CO., Olean, New York —Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors—gas, steam, electric and diesel driven.

DRESSER IDECO

DRESSER-IDECO COMPANY, Columbus, Ohio—Radio and television broadcasting towers, steel buildings, aircraft hangars, electric power substations.

DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

GUIBERSON

THE GUIBERSON CORPORATION, Dallas, Tex.—Swabs, packers, anchors, workover equipment—drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions. Gas lift equipment. Molded rubber products.

IDECO

IDECO, Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

LANE WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, packers and bridging plugs.

Magcobar

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells

ROOTS-CONNERSVILLE

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.

Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif.—Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Computers—analog and digital; recording systems. Special transformers, reactors.

WELL SURVEYS

WELL SURVEYS, INC., Tulsa, Okla. —Nuclear and electronic research and development for the petroleum and other industries. Originators of radioactivity logging.

*Trademark registered

put this DRESSER *plus+* team to work for you!

You receive a bonus of extra value whenever you are served by any one of the Dresser companies. *Men with imagination* provide the research, engineering, manufacturing and service applications for the particular specialties of each Dresser operating unit. All Dresser companies work together with their combined experience and facilities to form the world-wide Dresser industrial team. This inter-company teamwork offers a bonus in greater experience and technical knowledge – backed by the extensive Dresser facilities – in the customer's specific industry. This intangible but important factor is known the world over as the Dresser plus+ . . . the mark of superior equipment and services for the oil, gas, chemical, electronic, and general industry.

Dresser's world-wide engineering experience in many industries plays a major role in the creation of new developments and improved technological methods. No other single company provides the same broad range of equipment and services. The Dresser plus+ is a symbol for the superior quality of equipment and technical services which have become the standard of comparison in industries the world over!

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GAS, CHEMICAL AND ELECTRONIC INDUSTRIES — *EVERYWHERE*

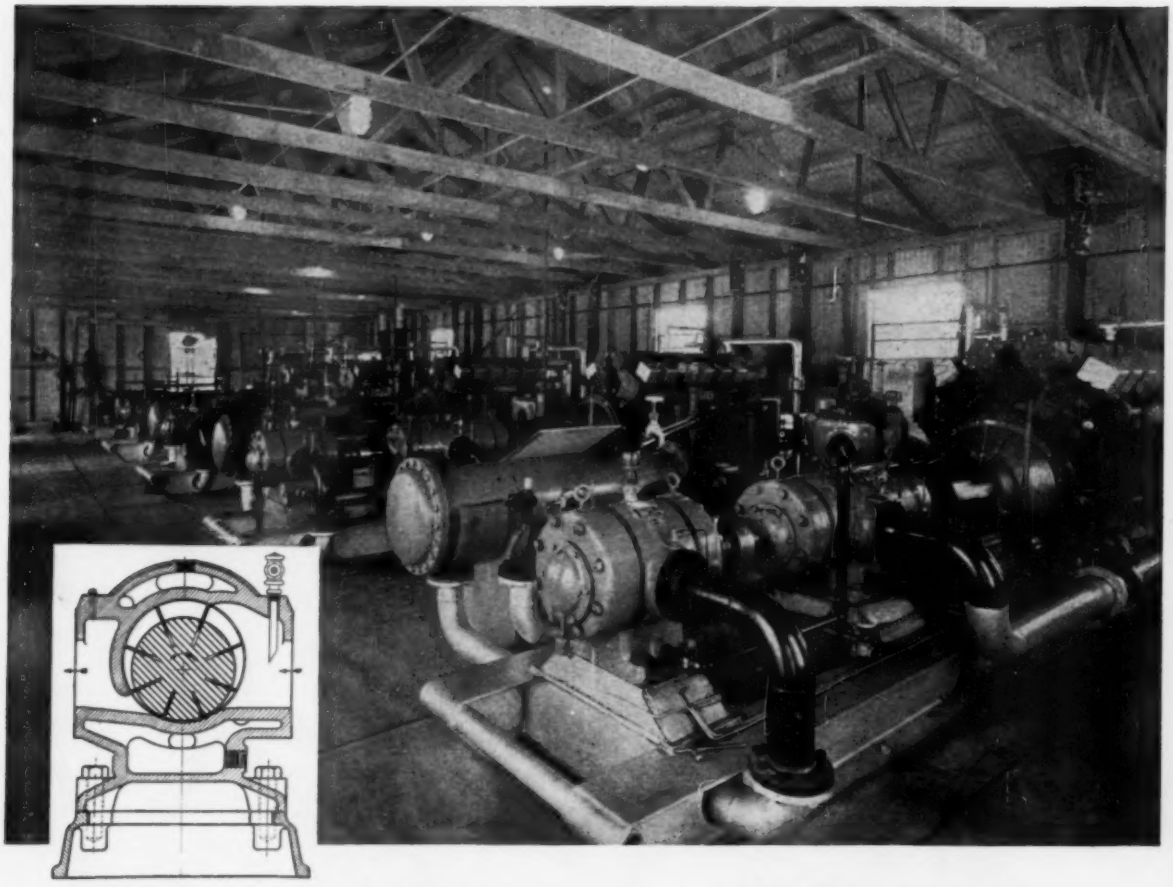
Roebling Royal Blue Wire Rope will **wear** and **wear** and **wear**!

This working quality means longer service life on *your* job. Add to this the fact that Royal Blue is stronger than the strongest rope you have been using and you have two excellent reasons why it has enjoyed faster acceptance than any wire rope in Roebling's history. Your distributor or Roebling Sales Office will give you the complete story, or contact John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Distributors, Branches and Warehouses Throughout the Country—Subsidiary of The Colorado Fuel and Iron Corporation

The "Inside" Story Of Fuller Rotary Compressors



Here, near Borger, Texas, is an installation of five two-stage Fuller Rotary Booster Compressors whose total capacity is 8,875,000 SCFD of casinghead gas compressing from 10 PSIG to 125 PSIG.

This same type of Fuller Rotary is used to boost gas into main booster stations and can be, and is, used where field pressures drop due to depletion. This latter use avoids expensive construction and increasing line sizes.

These, and other Fuller Rotary Compressors, now in widespread use throughout the petroleum industry, both indoors and out, incorporate trouble-free design that assures their dependability.

SIMPLICITY

The elimination of compressor valves, crankshafts, pistons and numerous other moving parts greatly reduces the need for attention, adjustment and replacement.

PULSATION—FREE FLOW

The smooth flow resulting from rotary compression eliminates pressure fluctuations and simplifies metering problems.

SUSTAINED PERFORMANCE

The blades are held out by centrifugal force, automatically compensating for wear, thus maintaining new-machine efficiency and/or capacity.

OPERATION WITHOUT VIBRATION

The rotary principle permits a compressor design completely free of reciprocating parts, thus avoiding the basic source of vibration.

The complete details, as well as sizes, of Fuller Rotary Compressors and Vacuum Pumps are available in Bulletin C-5A. We'd like you to have a copy. Send for it.

VISIT OUR BOOTH 1664
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FULLER COMPANY, 132 Bridge St., Catasauqua, Pa.

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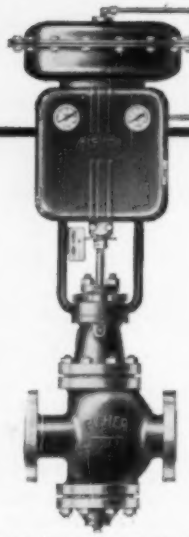
C-289
3026

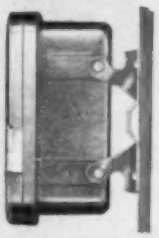
PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930



Any of the Wizard controllers can be yoke mounted on a diaphragm control valve to make a compact pilot operated pressure regulator as shown above. All Wizards are normally supplied with an operating medium air set which filters and reduces supply pressure of 25 to 250 psi to constant pressure of 20 psi for 3 to 15 psi, or 35 psi for 6 to 30 psi operation.

SURFACE MOUNTING

The Wizard can be mounted on the surface of a wall or any stable surface. A special mounting bracket is provided and any type of screw or bolt suitable for the mounting surface may be used.



FLUSH MOUNTING

By turning the bracket around that is provided for surface mounting, any Wizard can be mounted flush to a panel.

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

For closer control in today's

more complex processing industries

FISHER®

WIZARD II

PRESSURE CONTROLLER

For over a quarter century, the name "Wizard" has become a byword as the pressure controller that is accurate, dependable and simple to operate in all types of industry.

Now, the WIZARD II takes over to meet the demands of modern, complex control systems requiring closer control. The WIZARD II retains all of the basic simplicity, accuracy and dependability of the Wizard 4100U, plus a number of new components. The WIZARD II is in a waterproof aluminum die-cast case and cover with ¼" tapped vent for gas service. With the addition of a few parts, the basic proportional controller can be converted to: (1) two-position action or "Snap Action", (2) pressure transmitter, (3) controller with remote set adjustment, (4) proportional plus reset response. The WIZARD II can be changed from direct to reverse action or vice versa without additional parts.

The superior subassembly construction stresses simplicity and compactness. Each subassembly is assembled and calibrated prior to mounting in the case. All Series 4150 Wizards can be supplied for remote set adjustment for changing the pressure setting from a location away from the Wizard controller.

Careful and exhaustive tests have conclusively proved that the WIZARD II measures up to the rigid Fisher standards.

A completely descriptive and illustrated bulletin on the WIZARD II is yours for the asking. Write today for Bulletin No. D-4150.

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario

FISHER® Controls

SINCE 1880

ONE SIGNATURE
ONE RESPONSIBILITY
ONE HIGH STANDARD

INVESTIGATE PRITCHARD'S
SINGLE RESPONSIBILITY CONTRACT FOR YOUR NEXT CONSTRUCTION PROJECT

Let a Pritchard Single Responsibility Contract be the key to a successful construction project for you. Whether you are contemplating building a new plant, expanding or modernizing present facilities, Pritchard has a lot to offer you.

One Signature! You sign one contract with one firm; not a separate contract for each phase of the project. Pritchard handles everything including the design, engineering, purchasing and construction. The result is a saving to you in time and money. Things move rapidly. Design and Engineering are carefully coordinated. You benefit from the savings in quantity purchasing. Construction proceeds without costly delays.

One Responsibility! Responsibility for your complete satisfaction rests with Pritchard and Pritchard alone. This includes all phases up to and including final testing.

One High Standard of Performance! You know, before the project begins, exactly what it will cost. Specifications are established and you get what you pay for—nothing less. Pritchard gives you a firm guarantee of proper operation and maximum efficiency. There is only one standard of quality and performance with Pritchard: the very best.

YOUR INQUIRY IS INVITED

SERVING THE GAS, PETROLEUM, CHEMICAL, PETROCHEMICAL, PULP, AND PAPER INDUSTRIES AND THE POWER PLANT NEEDS OF INDUSTRY AND CORPORATE UTILITIES.

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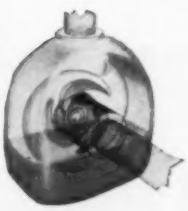
MANUFACTURERS
OF COOLING TOWERS AND GAS AND AIR TREATING EQUIPMENT

THESE PORTABLE PUMPS PRIME AT 30 FEET LIFT!



PUMP AT REST
Captured liquid retained for priming. Note absence of the usual check valve.

When rain, springs or seepage is clobbering construction, it's good to have Gorman-Rupp "80" Series Pumps ready in the equipment pool.

These new pumps prime and reprime at lifts of up to 30 feet. They move easily because of their lightweight, aluminum construction. (The Midget weighs only 48 pounds.)

Look at the cutaway views.

Straight-in suction delivers liquid directly to the impeller's eye. Capacity, efficiency and suction lift are increased. No *check valve.*

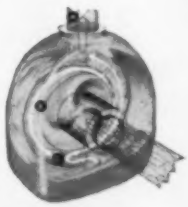
Four models:

Midget, 1½", 6,500 GPH, 2.25 HP;
Pelican, 2", 8,500 GPH, 2.75 HP;
Hawk, 2", 12,000 GPH, 5.5 HP;
Eagle, 3", 18,000 GPH, 6.8 HP.

You saw them at the Road Show. Buy them now at your Gorman-Rupp Distributor.

THE GORMAN-RUPP COMPANY

305 Bowman Street • Mansfield, Ohio



PRIMING ACTION
Entrained air (B) escapes at (A) to be discharged. Priming liquid returns (C) to entrain more air.

PUMPING ACTION
Straight-in suction voids entrance restrictions. Water enters direct to the eye of the impeller.

pumps, pours, dissolves under any condition

UOP AW(50)*

COPPER DEACTIVATOR

Even in exposed, below-freezing locations, UOP AW(50) Copper Deactivator flows readily, doing away with low-temperature pumping problems common to ordinary deactivators. And, whether you use AW(50) in the five-gallon manual-application size, or 55-gallon drums for automatic injection, it will not freeze and can be easily pumped even when stored for long periods at temperatures as low as 0°F.

In addition to superior pouring properties under low-temperature conditions AW(50) gives maximum metal deactivating efficiency and economy. It is instantly soluble in hydrocarbons, and is light in color.

UOP AW(50) is a "must" for refiners stabilizing gasoline, jet fuel, domestic heater oil and diesel fuel in all northern latitudes where temperature drops are extreme.

*Trade Mark

UOP

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U.S.A.

NEW! direct tank-mounted LIQUID LEVEL TRANSMITTER

Exclusive static pressure connection for closed vessels above or below atmosphere . . . eliminates need for second instrument.

This sensing diaphragm capsule flange-mounts directly on side of tank. All wetted parts of Type 316 stainless steel, with optional plastic coating for further corrosion protection.

with DIRECT 3-15 psi air output signal

IDEAL FOR: Viscous or corrosive fluids, slurries, and solids-in-suspension, as well as "easy-to-measure" fluids.

Now you can measure the level of "difficult" or easy-to-measure fluids — economically, without the complication of floats or bubble tubes, and with *sustained high accuracy over the entire range span.*

Flange-mounted directly to the side of an open or closed tank, the Type 13FA Transmitter eliminates piping and purging. Its stainless steel diaphragm capsule senses level changes instantly. Conventional tubing leads its output air signal directly to standard 3-15 psi receiver-recorders and controllers without need for intermediate signal converters.

The 13FA provides an accurate, trouble-free solution for level measurement problems. Write for detailed information, or ask your nearby Foxboro Field Engineer to explain its application to your specific process. **The Foxboro Company, 6010 Neponset Ave., Foxboro, Mass., U.S.A.**

FOXBORO

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LIQUID LEVEL TRANSMITTERS

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

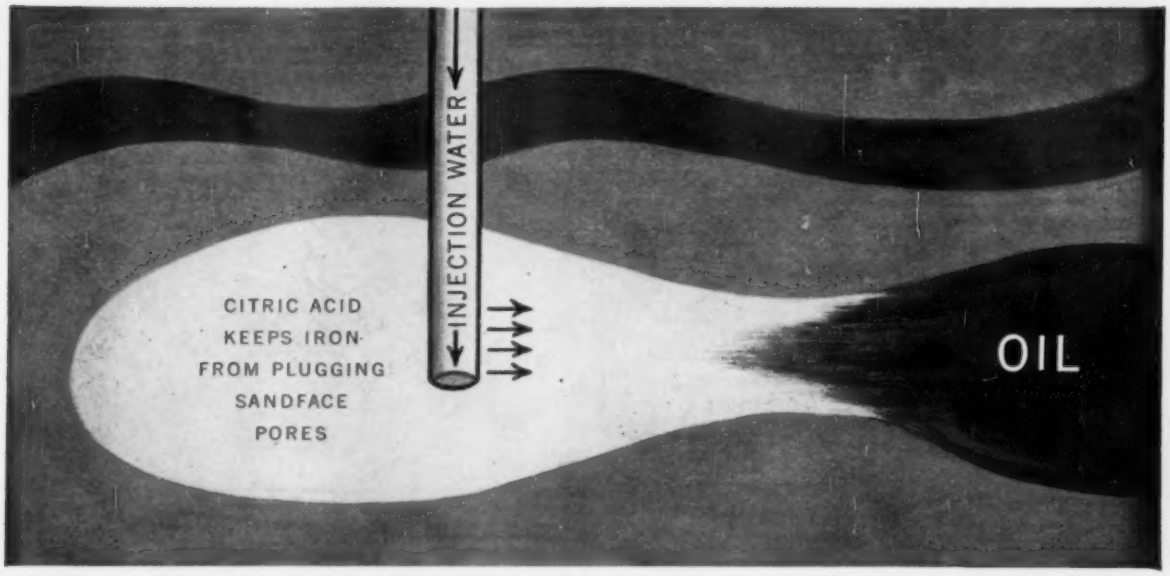
Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

Improve flow rates in secondary recovery



Add CITRIC ACID to injection water

● When you add citric acid to injection water you prevent the formation of iron precipitates which plug the sandface, restricting the flow rate. This means that you reduce the need for temporary (and sometimes costly) methods of freeing iron-plugged wells.

Also important, citric works even in high calcium waters. Citric preferentially sequesters the iron and keeps it soluble. Other ions do not interfere.

Pound for pound, citric acid sequesters iron better and at less cost than any other agent. It's nontoxic and safe to handle, too.

Pfizer supplies huge amounts of citric acid for a multitude of industrial uses throughout the world. This large volume production assures you of receiving all the citric you need without delay. For further information on preventing injection well plugging with Pfizer Citric Acid write to:

CITRIC ACID ADDED
In this bottle, only 10 ppm of Pfizer Citric Acid has been added to brine containing 2 ppm iron.

NO CITRIC ADDED
The brine in this bottle also contains 2 ppm iron. But no citric has been added.

CHAS. PFIZER & CO., INC., Chemical Sales Division
630 Flushing Ave., Brooklyn 6, N.Y.
Branch Offices:
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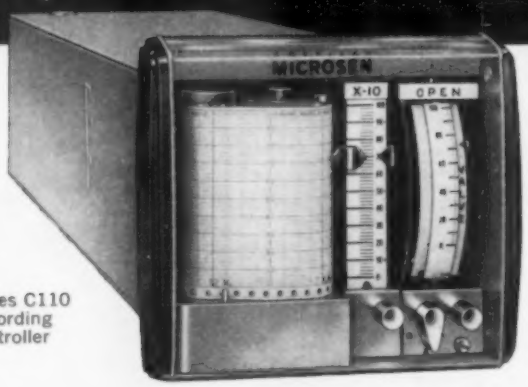
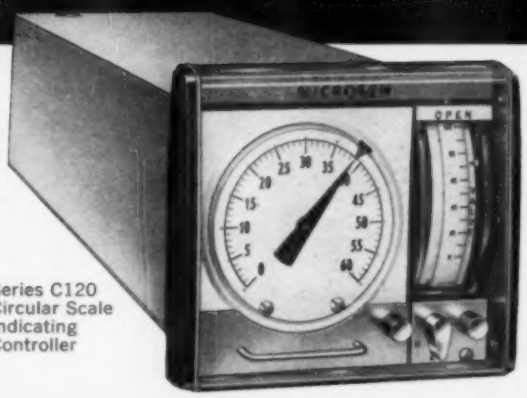
Manufacturing Chemists for Over 100 Years

Pfizer

NEW TRANSISTORIZED ELECTRONIC CONTROLLERS Interchangeable for complete versatility



Series C110
Recording
Controller



Series C120
Circular Scale
Indicating
Controller

The new 'American-Microsen' Series C100 Electronic Controllers can be interchanged at the panelboard in seconds. A recording controller to an indicating type . . . a proportional-action controller to proportional-plus-reset . . . slow reset to fast reset – any of these replacements is quickly made by pulling one unit out and plugging in the other.

The controller settings of the 'American-Microsen' System are all calibrated and repeatable. When a controller station is replaced, the proportional, reset and rate settings can be made in advance so the process is on control the instant the change-over is completed. No playing around to tune in the control.

When the process is on manual control during a replacement operation, the controller station stays in balance with the actual valve position. Thus the process can be changed back to automatic control without "bumping" or upset. A unique feature of the 'American-Microsen' System eliminates any "balance" or "seal" position between manual and automatic.

These are but a few of the many functional advantages of the new 'American-Microsen' Electronic Control System. Join the many satisfied users of this new approach to process control. Make certain you have the better control and simplified servicing so essential to higher product quality and greater operating economy. Arrange for a meeting with one of our sales engineers to determine the best equipment for your service. *Write for Bulletin RC100.*

Controller Performs These Functions

Measures input signal from transmitter and records or indicates in terms of the measured variable — pressure, temperature, flow, etc. (The Series C110 records on a 3-inch wide strip chart, the Series C120 indicates on a 4-inch diameter scale.)

Provides means of setting the desired value of the measured variable (set point) and compares actual value with desired value.

Transmits control signal, incorporating proportional, reset, and/or rate actions to operate final control element.

Provides means to operate control element manually with simple switch and manual knob.

Ultra-Modern Features Provided

All functions of recording (or indication), controlling (proportional, reset, and/or rate), and manual valve operation *in a single housing.*

Transistorized controller station for ultimate reliability and long service life.

Printed circuitry and miniaturized components for space-saving simplicity.

Plug-in units for complete interchangeability and ease of maintenance.

Ratio, cascade, and other similar control arrangements, using standard instruments.

Direct bumpless transfer from manual to automatic control with no intermediate position.

DC signals of 1.0 to 5.0 milliamperes for instantaneous distance transmission up to 30 miles.

Controllers are compatible with any unit of other manufacture using the standard 1 to 5 milliampere DC signal.

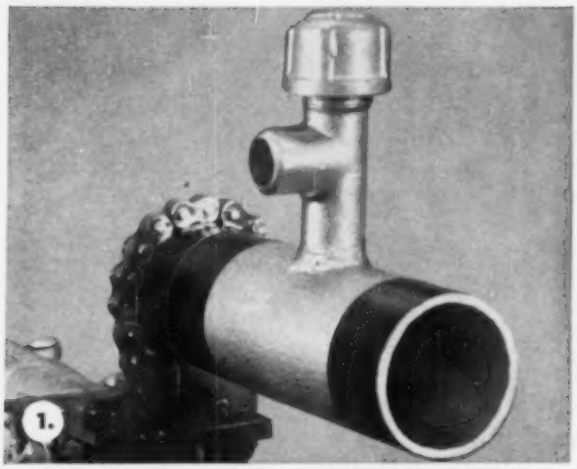
MANNING, MAXWELL & MOORE, INC.

MAXWELL MANNING MM&M & MOORE INC. TRADE MARK

INDUSTRIAL CONTROLS DIVISION • STRATFORD, CONNECTICUT

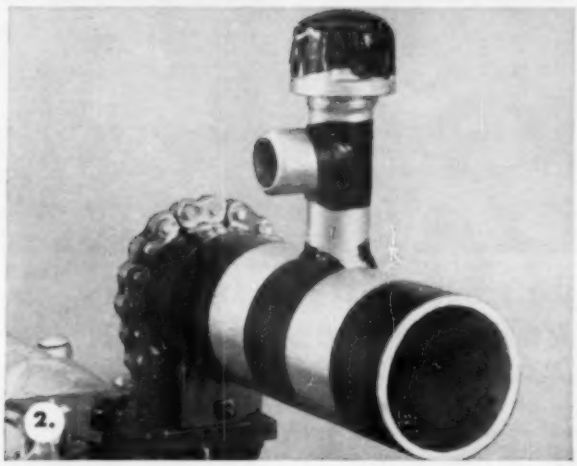
MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

The tape that fits to a "T"



A remarkable ability to conform to irregularly shaped contours . . . plus all the advantages of polyethylene

Three easy steps in wrapping a T-joint with *Polyken* Polyethylene Tape No. 940. Note the way this highly conformable tape adapts itself to every twist and turn.



If you have pipe contour problems, this one's for you. Where you need it, it's a valuable new companion product to *Polyken* No. 900 polyethylene tape coating—the ideal coating for straight-pipe runs.

***Polyken* No. 940**—is made especially for use on valves, fittings, ells, T-joints and other irregularly shaped pipe connections. All the superb corrosion resistance of polyethylene . . . plus an extremely high degree of conformability.

No. 940 is a truly balanced product which offers the right combination of elastic memory and dead stretch. Financially, it can mean a nice saving on maintenance.

We'll be glad to figure application costs on your job. Write, wire or phone today: The Kendall Company, Polyken Sales Division, Dept. OG-J, 309 W. Jackson Blvd., Chicago 6, Illinois (WEbster 9-7100).

Complete catalog, Sweet's Industrial Construction File, Sec. 3J/Ke

Polyken®

PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

ACCO
for Better
Values

R-P&C VALVES

THE COMPLETE LINE
—DESIGNED FOR DEPENDABILITY

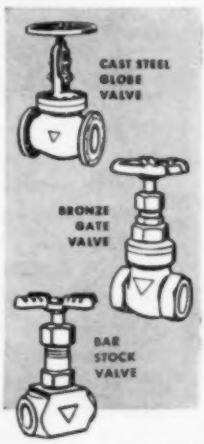
Created by R-P&C—made and sold exclusively by R-P&C...Electric Furnace Iron Valves

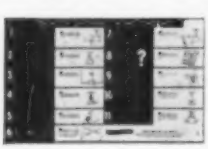
Electric furnace iron—introduced exclusively in R-P&C Valves—provides a high quality cast iron that meets the exacting requirements for pressure castings. Melted and refined under closest metallurgical supervision, R-P&C Electric Iron has physical properties *far exceeding the minimum standards* to which they must conform. It has a balanced chemical composition and a tough, dense body structure; and, it is more resistant to corrosion. All cast iron parts of R-P&C Valves are made of this Electric Furnace Iron.

Shown above is **Fig. 625**, a general service valve which is particularly applicable where full, unobstructed flow is desired. This type, available in bronze-trimmed or all-iron style, either flanged or screwed, is made in fifteen sizes, from 2" to 24"—and is typical of the better values offered by the entire line of R-P&C Electric Iron Valves.

The R-P&C Line is Complete

The R-P&C line embraces gate, globe, angle and check valves in bronze, electric furnace iron and cast steel, and forged steel; all in a wide range of sizes, styles and pressure classes. Also, R-P&C offers specialties such as Lubrotite gate valves, bar stock valves, asbestos-packed cocks, cast steel fittings and pressure-seal cast steel valves. Order through your nearby R-P&C Distributor. For complete catalog, write our Reading office.



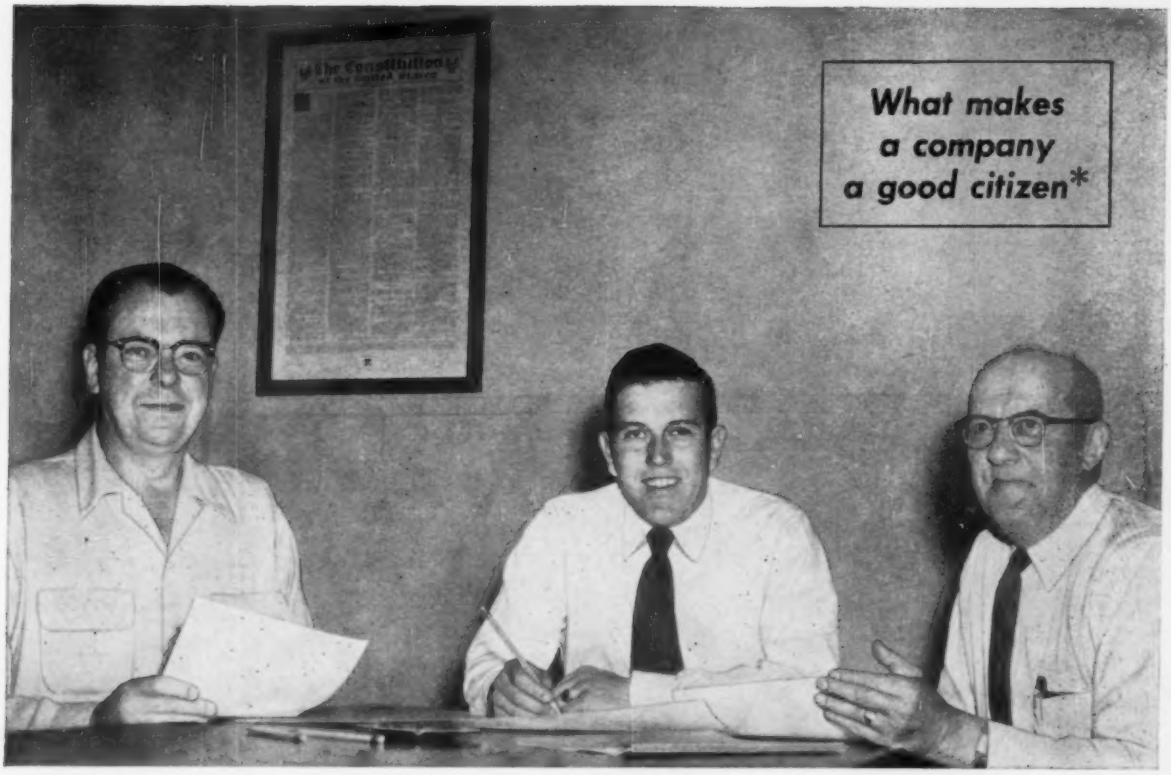


FREE WALL CHART
"How to Protect Your Valves"
Installation pointers, operating tips, clues to longer valve life. They are all on this 22" x 17" wall chart. Write for your free copy.

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

ACCO



City business of Harbor Springs, Michigan, is under discussion. The city officials pictured above are (l. to r.) City Manager A. C. Wager, Donald D. Jardine, mayor pro tem., who also is a Standard Oil dealer, and R. J. Hilderbrant, city clerk.

The mayor leads a double life!

Donald D. Jardine of Harbor Springs, Michigan, has led a constructive "double life" for years. He has served as a Boy Scout leader, as a special policeman for civil defense or other emergency, as an officer of a community improvement association and as a member of the Harbor Springs City Council. Today, as mayor pro tem., he devotes every hour that can be spared from his family and his business to conscientious conduct of Harbor Springs' affairs.

And, during the same years, Donald Jardine has been building a successful business. Five years ago he borrowed the money to acquire his own independent business, a Standard Oil service station. Now, his debt repaid, he has one of the finest and most successful service stations in this part of the country. He found something he liked, and he found success by staying with it!

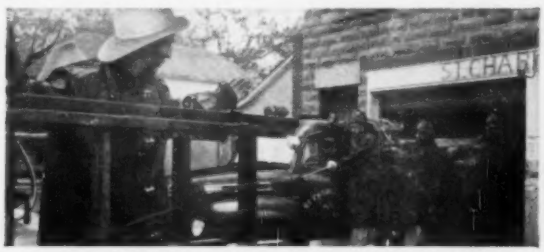
Donald Jardine is one of many Standard dealers throughout Mid-America who lead "double lives," lives of service to the motoring public and to their communities.

We're proud of the fact that thousands of Standard's own employees, too, give freely of their time and talent to civic and human welfare activities. All over this part of the country you'll find our agents, chemists, salesmen, engineers, accountants, refinery people and others active in church, school, 4-H, FFA, Boy Scout, and other jobs done by good citizens.

*** What makes a company a good citizen?**

Responsible companies, like responsible people, contribute to the security, the economic health, and the general well-being of the communities in which they live and work.

Clayton A. Johnson, second from left, is shown presiding at a meeting of the school board in Bancroft, Michigan. President of the board, he also is active in other community affairs. He believes it is his duty as a citizen to serve in community projects. Mr. Johnson is a Standard Oil agent.



Richard L. Browne, in white helmet, is chief of the volunteer fire department in St. Charles, Michigan. He has served as a volunteer for ten years and has been chief for three years. Why? Because he likes to serve the people of his community both on and off the job. He is a Standard Oil dealer.

STANDARD OIL COMPANY (INDIANA)

DEPENDABILITY IS A TRUE STORY WITH PARKERSBURG PUMPING UNITS

Trouble-free performance for 24 years is the outstanding service record of the Parkersburg chain-driven pumping unit shown above, right. Twenty-four years of operation for a leading major company, first in the wet, humid fields of East Texas then in the sand-pelted, wind-whipped Permian Basin, without maintenance cost other than changing oil and replacing a link in the chain drive.

Producers everywhere know that similar dependable service can be expected of the new Parkersburg gear-driven pumping unit at left, above, that has recently been installed with the older unit to produce two zones in this well. For dependability is a tradition with Parkersburg pumping units. They are dependable because they are designed and manufactured to give trouble-free performance.

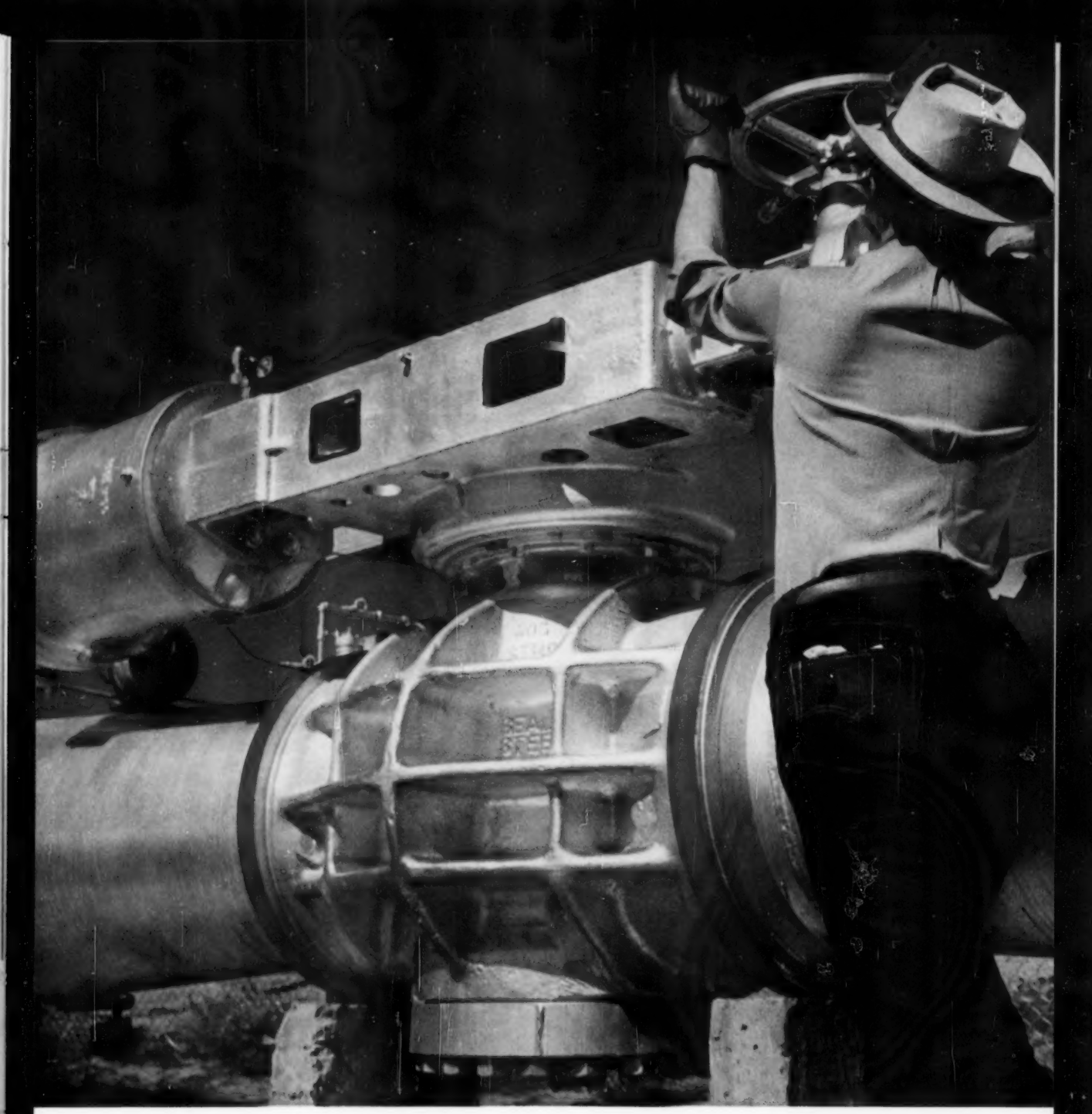
Buy dependability! It costs no more when you specify a Parkersburg pumping unit. And Parkersburg has a pumping unit to fit any requirement.

At Parkersburg, Quality and Service Have Gone Hand-in-Hand for 60 Years!

The
PARKERSBURG
RIG & REEL COMPANY

DIVISION OF PARKERSBURG–ÆTNA CORPORATION

PUMPING UNIT DIVISION OFFICES:
710 Mid-Continent Building — Tulsa, Oklahoma



EMERGENCY! Are you sure your key valves will operate when an emergency comes? They will, *if* they are Rockwell-Nordstrom valves with *pressurized lubrication* that makes operation fast, easy and *sure*.

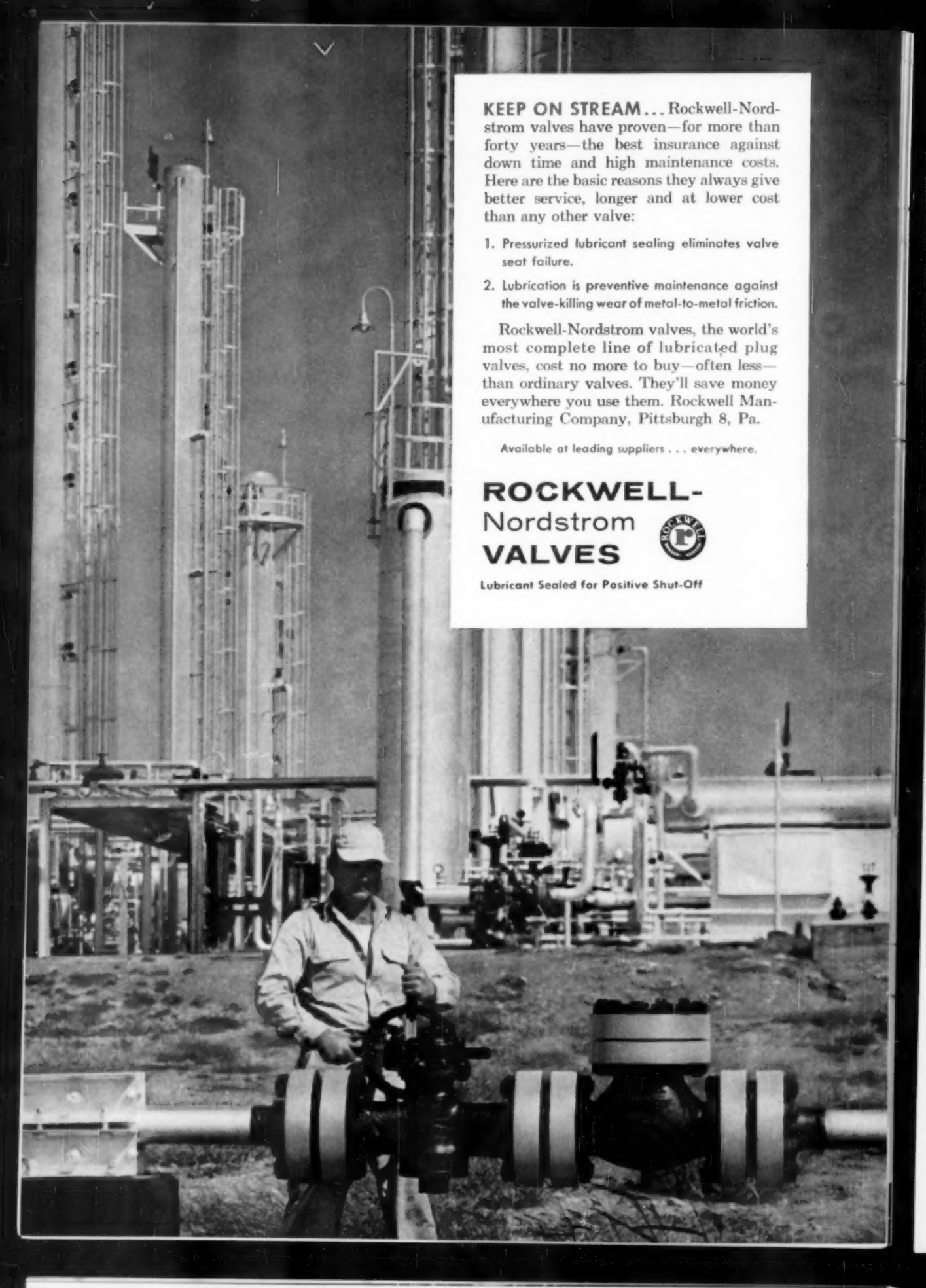
Unlike the forced seating in ordinary valves, the Rockwell-Nordstrom valve plug is kept friction-free by lubricant—frozen or stuck valves are eliminated. And quarter-turn closure is two to five times faster.

The lubricant in Rockwell-Nordstrom valves does another important job: it eliminates metal-to-metal wearing friction for longer valve life. Yet with all their obvious advantages, Rockwell-Nordstrom valves cost no more to buy, often less, than ordinary valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off


KEEP ON STREAM... Rockwell-Nordstrom valves have proven—for more than forty years—the best insurance against down time and high maintenance costs. Here are the basic reasons they always give better service, longer and at lower cost than any other valve:
1. Pressurized lubricant sealing eliminates valve seat failure.
2. Lubrication is preventive maintenance against the valve-killing wear of metal-to-metal friction.
Rockwell-Nordstrom valves, the world's most complete line of lubricated plug valves, cost no more to buy—often less—than ordinary valves. They'll save money everywhere you use them. Rockwell Manufacturing Company, Pittsburgh 8, Pa.
Available at leading suppliers . . . everywhere.
ROCKWELL-
Nordstrom
VALVES
Lubricant Sealed for Positive Shut-Off

Here's Why...

Silicone Insulated Transformers Provide Reliable Power Anywhere

Locate them anywhere near the load —on the floor, a balcony or wall . . . dry-type transformers insulated with Dow Corning Silicones are lightweight, space-saving and easy to install. They fit into any plant layout. And equally important, they cost less to install, less to maintain, far less in the long run!

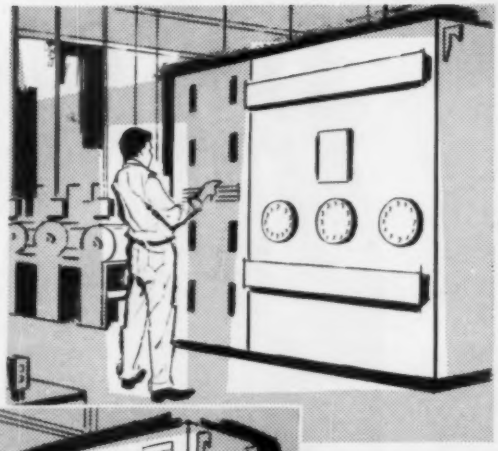
Easy, low-cost installation. Simply connect the necessary leads and throw the switch! Neither sealed nor open type silicone-insulated transformers require costly vaults, barriers or ventilating fans. And they don't contain liquids that can burn, explode or give off toxic fumes. They're completely dry, completely safe.

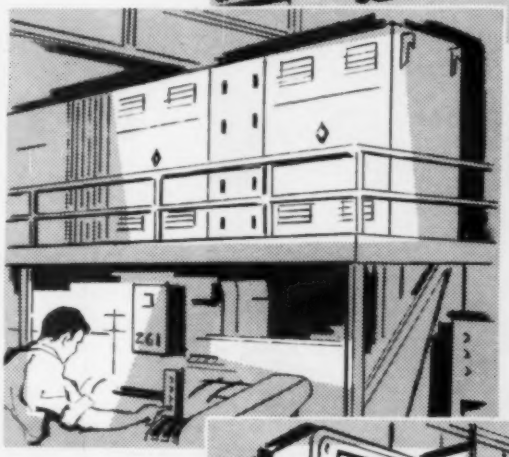
New freedom from maintenance. With no liquids to maintain or toxic fumes to guard against, you install dry-type transformers and virtually forget them. Even in open-type transformers, silicone insulation assures reliable power despite contaminated atmospheres, dust, dirt, moisture or high ambients.

Maximum reliability. Dow Corning silicone insulation has sufficient thermal capacity to handle temporary overloads up to 25% above rated capacity. This extra capacity assures the ultimate in uninterrupted, reliable power for automation . . . continuous processing . . . and all plant functions.

Send today for a list of equipment manufacturers who supply Dow Corning silicone-insulated dry-type transformers.

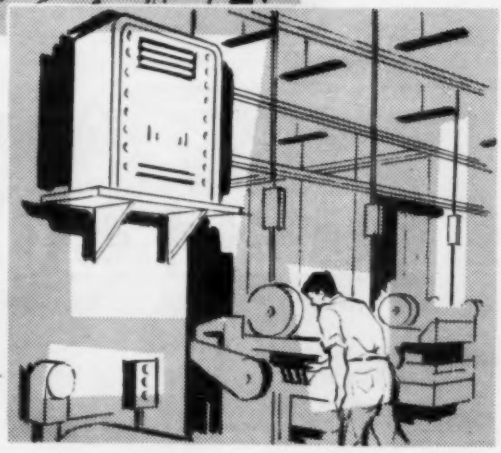
ON THE FLOOR
maximum safety; freedom from maintenance; easy to install





BALCONY
15% lighter than next lightest type; save floor loading

OR WALL
lightweight wall or platform mounted units save floor space



Specify DOW CORNING SILICONES *and Save*

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C

lift loads from any depth.....

WITH THE TYPE 'L'

Finest Tubing Swab Cup Made For Lifting Heavy or Light Loads

When you're swabbing from any depth or want to unload the well completely, you can do a better, more efficient job with the Guiberson Type L on the regular Guiberson Swab. This unbeatable combination drops fast and seals perfectly for the lift — and has the flexibility and durability to do a top-notch job. Capable of lifting heavy loads, this versatile cup will also lift the last light loads from the bottom of the well. The L lifts *full* loads, not just part way but all the way to the surface, slipping by collars just as though they weren't there. The next time you need a a general purpose swab cup, get the Type L. Look for it at any supply store, packaged in pairs in the brilliant blue box.

THE GUIBERSON CORPORATION

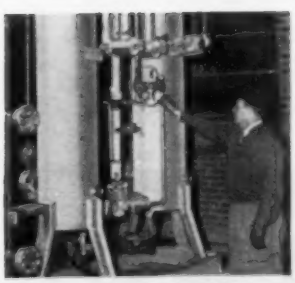
ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by Oil Field Supply Stores Everywhere

Some of the many available desiccants

It takes an expert prescription to dry gas properly . . .

Come to Kemp



Kemp Model 300 S Dryer protects pneumatically operated instruments at Sun Oil's Marcus Hook Plant. This unit has operated continuously since installation with little or no attention, giving specified performance at all times.

Over 20 *different* desiccants . . . each with its own particular properties and uses. It takes experience to choose the right one and engineer it into a drying system that will exactly meet your needs.

Kemp offers you that experience . . . almost a quarter-century in designing and building drying apparatus. Kemp engineers combine the right equipment and the right desiccant into a unit that brings you dependability, ease of maintenance, and simplicity of operation. For any use . . . guarding pneumatically operated instruments and tools . . . drying process gasses and inerts for blanketing and purging . . . pressurizing anhydrous liquids . . . liquid drying or any of a host of other applications . . . a Kemp Oriad or Convection type dryer will give you high efficiency drying at low cost.

To improve performance and cut costs in your operation, have Kemp engineers recommend a system for your plant. Your Kemp Representative will give you detailed information, or write direct for Bulletin D-100. The C. M. Kemp Mfg. Co., 405 East Oliver St., Baltimore 2, Md.

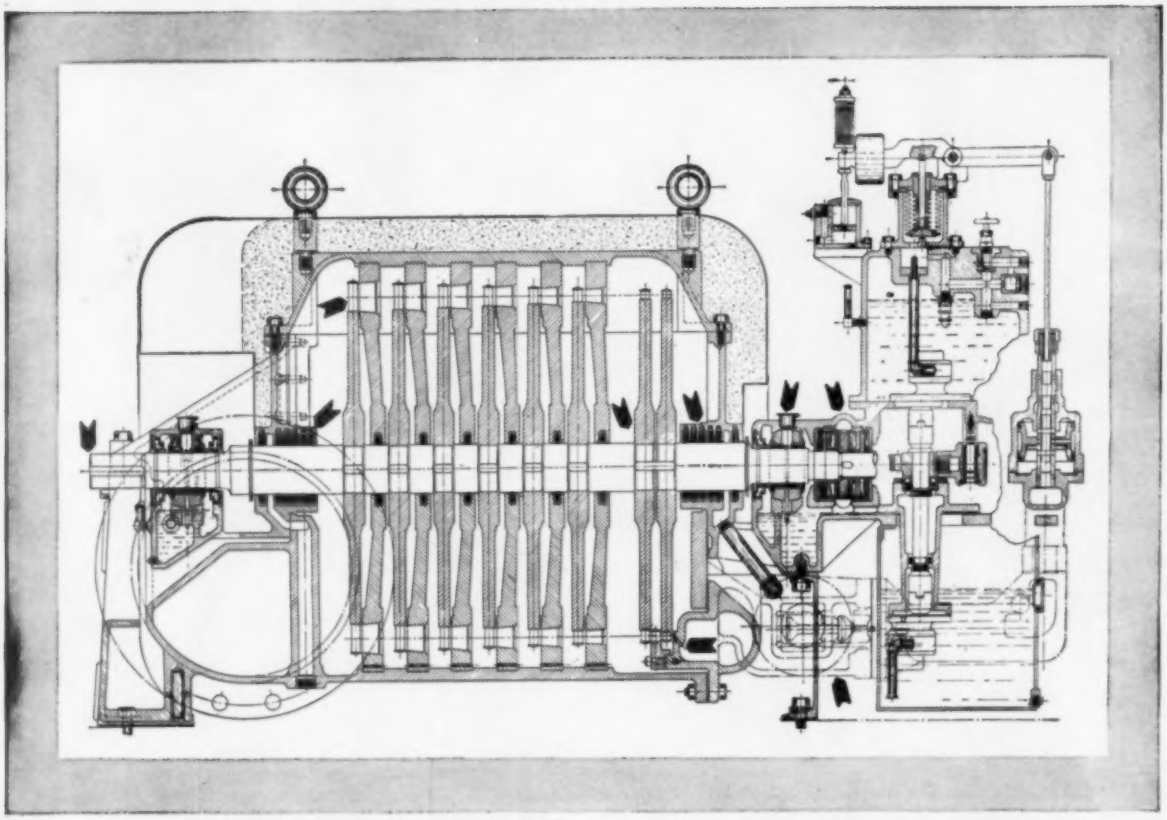
Kemp Convection Dryers

Kemp Inert Gas Generators

KEMP OF BALTIMORE

Kemp Industrial Carburetors

Kemp Oriad Dryers



ANOTHER INSIDE STORY OF THE UNIVERSAL ACCEPTANCE OF MURRAY MULTI-STAGE TURBINES IN THE MECHANICAL DRIVE FIELD

- Husky accurately machined shaft.
- Discs shrunk and keyed in place.
- Stainless steel nozzles and blading throughout.
- Spherical seated sleeve bearings.
- Kingsbury thrust bearing.
- Center line support.
- Carbon ring gland seals.
- Double seated balanced governor valve — stellited.
- Choice of speed governors from simple mechanical type to precision oil relay.
- Bolt type overspeed trip governor.
- Steam conditions to 600 PSIG and 750°F.
- Condensing or non-condensing.

Our nearest representative will gladly help you solve your mechanical drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa, for his name.

★ ★ **Murray Turbines** ★ ★

They Say—

Texas offshore disappointing

"Thus far, some 120 holes have been drilled in Texas' gulf waters and a goodly number, 41, have been successful. But the amount of oil and gas found—the real payout—has been disappointing, to put it mildly. As the oil men see it, the geologists are finding structures but not oil . . .

"Take the experience of Standard Oil Co. of Texas . . . Of the 41 completions, Sotex was responsible for 21—9 oil and 12 gas. All the gas wells are shut in awaiting pipelines. During July, the 9 oil wells were permitted by the state regulatory body to produce at the rate of 570 bbl. a day—a per well average of a meager 63 bbl. a day.

"This is the return that Sotex is currently getting from its total offshore investment of $33 million since 1952.

"The industry picture is no better. Today, total oil production from Texas offshore wells is less than 1,000 bbl. a day.

"There probably is more oil off Texas yet to be found, but the job of finding it promises to be a much more difficult and expensive venture than had been expected by many."

From an article entitled "Texas Offshore No Bonanza" in the September issue of The Standard Oiler, Standard Oil Co. of California publication.

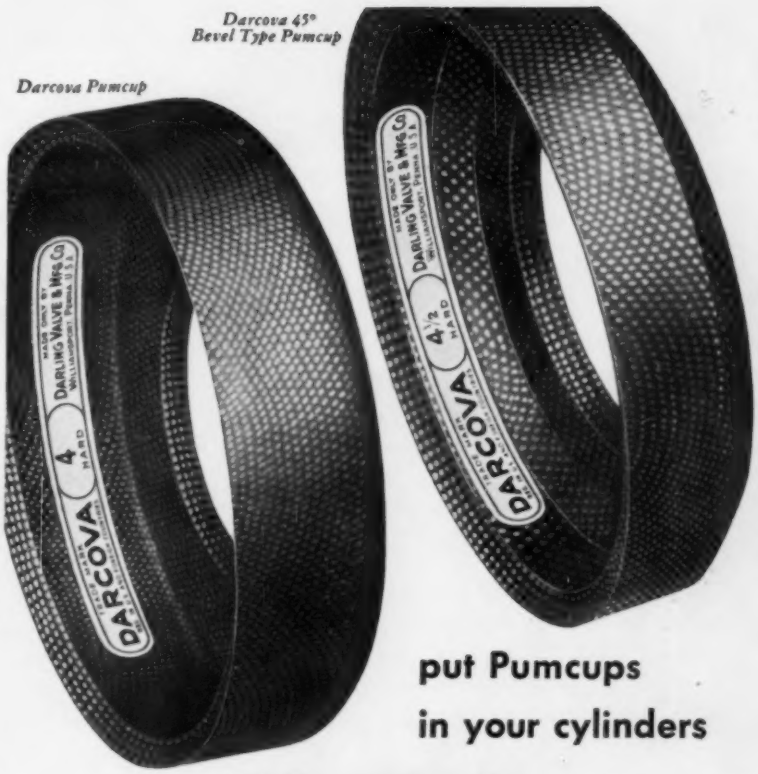
Alberta's gas export debate

"With hearings before the Alberta Oil and Gas Conservation Board slated to start in a few weeks on proposed gas export pipeline projects linking the Alberta foothills belt reserves with markets in the United States West Coast region, there has been a renewal of debate in the province over the question of gas export. The most frequent argument against additional export is that it might endanger the long-term security and price for consumers in Alberta.

"The great fallacy of the argument that Alberta gas supply might be endangered by export is that it considers only 'proved reserves' existent today; ignores the considered view of all industry and government authorities that the undiscovered reserves are many times greater than those currently proved, and that the best means of encouraging exploration for and discovery of the still-hidden reserves is

Darcova 45° Bevel Type Pumcup

Darcova Pumcup



put Pumcups in your cylinders

TO HOLD PRESSURE LONGER!

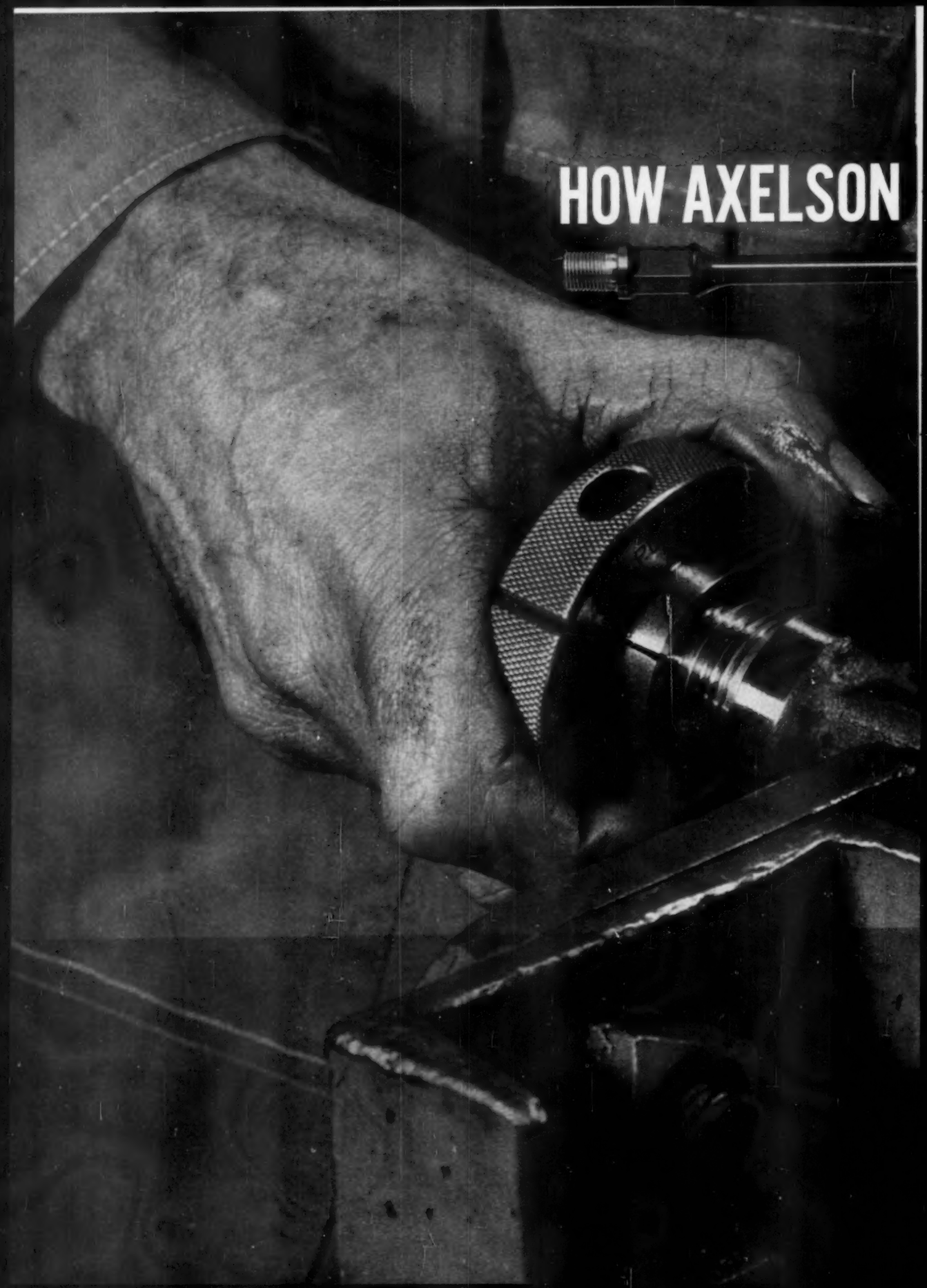
In Darcova Pumcups a sound engineering principle has been combined with precision tolerances and extremely durable compositions to provide exceptional efficiency and life in hydraulic, air, and reciprocating pump cylinders of all kinds.

Unlike ordinary piston packing, precision Pumcups are engineered to minimize friction load while hugging cylinder walls on every pressure stroke. Regardless of eventual wear, efficiency *stays* high! So there's far less down-time and need for replacement.

Pumcups are made in a wide range of sizes, types and texture-engineered compositions, including 100% Nylon, for all kinds of pressure-temperature-fluid conditions. Send for Pumcup Bulletin 5503 and weigh all the facts!

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS


HOW AXELSON

PUTS MORE LIFE IN SUCKER RODS

100% inspection guarantees perfect threads

Expert AXELSON inspectors test *both ends of every sucker rod* with three precision thread gages. Their job is to assure perfect threads – preventing sucker rod failures that result in expensive pulling jobs and down-time.

Each rod is checked for accuracy with "Go," "No-Go" and "Standoff" thread gages. In turn, these instruments are checked daily for accuracy against master API gages.

The moment a rod comes off the threading machine, pin threads are carefully inspected to maintain constant control over machine performance. Seconds later threads are coated with a heavy protective compound to prevent rust and corrosion . . . a thread protector is screwed on at one end and a Parkerized coupling with a plug added to the other. After its seventh and final inspection, another AXELSON sucker rod is ready to go to work. *For complete sucker rod comparison data, write for Chart PO10-PS9A.*

In 59 years of manufacturing equipment for the petroleum industry, AXELSON has pioneered many methods for putting more life in sucker rods:

METALLURGICAL CONTROL OF RAW MATERIALS . . . the first step in quality control.

HEAT TREATMENT . . . to insure uniform grain structure, strength, shock resistance.

ABSOLUTE STRAIGHTNESS . . . checking and rechecking after passing through a Medart bar straightener.

FORGING . . . to exact alignment with precision forging dies.

CLEANLINESS . . . complete removal of "scale" by shot blasting.

PAINTING, STORAGE AND SHIPPING . . . the important final steps in manufacture.

AXELSON

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON MANUFACTURING COMPANY

Division of U.S. Industries, Inc.
6160 So. Boyle Avenue, Los Angeles 58, Calif.

Every AXELSON sucker rod *is checked at both ends with three thread gages. Protective coating, coupling and cap are added immediately after inspection to protect threads and prevent rust or corrosion.*

The threads of AXELSON *Parkerized couplings undergo the same rigid inspection as rod pin threads. Accuracy of coupling and rod pin threads assures perfect alignment, tight joints with greatest bearing surfaces.*

to generate enthusiasm and capital by opening markets for a bigger part of today's shut-in resources.

"The great fallacy of the argument that Alberta gas prices to consumers might be endangered by export is the assumption that our gas resources can permanently be set apart from the normal laws of the market place governing the price fluctuations of most of the commodities used by humanity, unless we are prepared to assume a permanent complexity of government controls and aids that would over-all be far more costly to the economy than free interplay of competition between competing fuels, and competitors for the same fuel.

"Another great fallacy of the price argument is that it assumes there would be an automatic sharp rise in Alberta gas-consumer costs if export doors are opened wider . . .

"Actually wellhead gas values are a small percentage factor in costs to consumers. The distance of Alberta gas fields from major export markets and competition with other fuels set tight ceilings on wellhead values here that are below wellhead values for gas in other major North American reserve areas, and only a small fraction of mine and wellhead values of the chief competing fuels (oil and coal)."

Carl O. Nickle, member of Parliament, in a speech to the Alberta Society of Petroleum Geologists.

A toothless import plan

"It is too late for halfway measures.

"Texas has been bearing the brunt of the production cutbacks caused by excessive oil imports. This state cannot continue on a 13-day production schedule indefinitely without facing serious damage to the general economy and a critical loss of tax revenue.

GOV. DANIEL

"The voluntary imports program is a toothless method of attacking a problem . . . I hope the administration will soon more forcefully do something about this problem."

Gov. Price Daniel of Texas, in a speech to the Independent Natural Gas Association of America.

Nautilus makes history

"Probably the best of the specific examples of the value of atomic energy to our military power is the case of our first atomic submarine, the U.S.S. Nautilus. As we know, the Nautilus went over 60,000 miles or 2¾ times around the earth and actually used a calculated 8⅓ lb. of enriched uranium.

"Think of 8⅓ lb. of fuel sending a submarine 2¾ times around the earth. That would ordinarily take some 57,140 bbl. of oil! Obviously, the Nautilus has made naval history."

J. Carlton Ward, Jr., president, Vitro Corp. of America, in a speech to the Institute of Aeronautical Sciences.

No U.S. aid for socialism

"The U. S. is convinced that private ownership and operation of industrial and extractive enterprises contribute more effectively than public ownership and operation to the general improvement of the economy of a country through better management, research, quality control, lower prices, increased employment, and capital growth.

"It is, therefore, a basic policy of the International Cooperation Administration to employ U. S. assistance to aid-receiving countries in such a way as will encourage the development of the private sectors of their economies. Thus, I.C.A. will normally not be prepared to finance publicly owned indus-

meets every requirement

the Dean Hill sulphur pump

low cost operation
heavy duty construction
reliability

The Dean Hill vertical, molten sulphur pump equipped with a DH vertical steam turbine drive. (Available also with vertical hollow or solid shaft motor drive.)

Like all Dean Hill products, this sulphur pump incorporates all of the features to give you years of trouble-free operation. Complete steam-jacketed line shaft and discharge column assures free flow at all times. Actual liquid sulphur lubricates bearings and shaft damping bushings. The Dean Hill sulphur pump is a compact, self-contained, rigid, smooth-running mechanism capable of superior service at all times. For complete information write today, without obligation.

DEAN DH HILL PUMP COMPANY
Pump and Turbine Engineers Since 1893
Indianapolis 7, Indiana

SALES OFFICES IN PRINCIPAL CITIES.

Why Lower-Groove Compression Rings Need Supplementary Pressure

Pedrick Formflex Seal-Cut Conformable Compression Ring

The force or pressure of the compression and combustion gases back of the rings is one of the most important factors in keeping the compression rings pressing against the cylinder walls for a satisfactory seal. The tension built into the ring contributes to this, but in a relatively minor way.

The top compression ring enjoys the greatest assist from combustion-chamber pressures. The gas pressure available to the second ring is only what passes through the top-ring gap, and is substantially less than cylinder pressure. The pressure behind the 3rd ring is still further reduced. Thus, by the time the gas pressures reach the lowest compression ring usually there is not sufficient force to enable the ring to maintain a seal, and it is here that it is most important to maintain a seal to prevent the gases from going further.

The ring used in the lowest compression groove needs special assistance to do its job. This is provided in the Pedrick FORMFLEX Seal-Cut compression ring. It is a single cast-iron ring of much less radial thickness for greater conformability and response to pressures. Its special-design of overlapping ends close the gap completely. Its big assistance comes from the Pedrick "Equalizer" which backs it up and provides adequate additional outward pressure to seal at the cylinder wall and stop blowby. This pressure is exerted everywhere around the ring and is absolutely uniform.

The result is a ring conformable enough to follow cylinder-wall irregularities and with enough pressure to maintain an effective seal. Power is preserved. Contamination of the lubrication oil from blowby gases is avoided. There is no build-up of undesirable and potentially-dangerous gas pressures in the crankcase.

Why not get the full benefit of Pedrick's experience in the design and application of conformable compression, as well as conformable oil rings, to your big diesel and natural-gas engines? For engineering details on the application of conformable compression rings, write for Form 434. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

Pedrick PISTON RINGS

PEDRICK PIONEERED *Conformable* RINGS FOR BIG-BORE ENGINES

for

easy to make

connections

join pipe

THE DRESSER WAY!

Anywhere you're joining pipe, the handiest, surest way to get safe, bottle-tight joints is with Dresser Couplings or Long Sleeves.

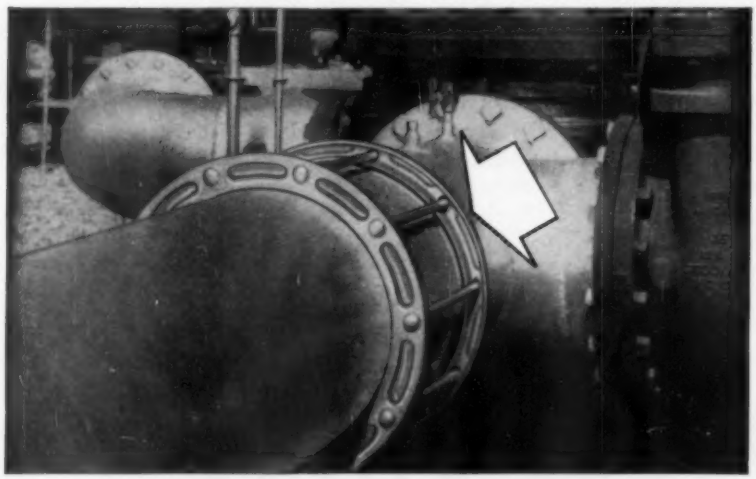
Dresser Couplings provide the "give and take" necessary to absorb vibration, settlement and other stresses. Specially compounded rubber gaskets permit up to 4° deflection at joints — yet with Dresser Couplings, these joints stay permanently tight.

The only tool you need is a wrench — pipe threading is not necessary. Any workman can install Dresser Couplings, averaging only two man-minutes per bolt.

DRESSER®

Dresser Manufacturing Division • Bradford, Pa.

A 16" Dresser Coupling on a water jacket in a field processing plant



AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

Style 38 Coupling

Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling

trial and extractive enterprises, although it is realized there may be exceptions."

John B. Hollister, director, International Cooperation Administration.

Refiners take home top pay

"Refinery workers are among the highest paid production workers in American industry. Weekly earnings averaged over $108 in 1956, and hourly earnings, $2.65, compared with the average of $80.19 a week and $1.98 an hour for all manufacturing. Since 1947, hourly earnings have risen by 69 per cent, compared with 60 per cent in manufacturing as a whole."

From a Bureau of Labor Statistics report on petroleum refining.

El Paso paper sounds off

"The (State) Legislature, with the approval of the Governor, has raised the cost of living in Texas . . .

"Now it costs more to get married because the license is higher, more to get a divorce because the court fees have been raised . . . Now it costs more for a fellow to go hunting or fishing . . . The tuition of the young people attending the 18 'free' colleges and universities of Texas has been raised from $100 to $200 a year. This means 50,000 young Texans will pay the state $5,000,000 more than last year . . .

"Of course, there was no increase in the taxes of the very wealthy oil firms that deplete Texas' natural resources by a billion barrels of petroleum a year.

"This stuff, you know, sells for $2.80 a barrel. It is brought to El Paso's refineries, and from it there is extracted 20 gal. of gasoline.

"The oil people pay a tax of 13 cents a barrel; the user of the gasoline from it pays the state $1. Isn't it sweet of our state government to let us off so easy—only seven times as much as the oil producer pays!

"Then, in El Paso, 20 gal. of that gasoline—regular grade—is sold wholesale to the filling station for $3.72. That's 42 to 48 cents more than Texas cities east of the Pecos pay.

"It's a nice profit on the $2.80-barrel, not counting the things other than gasoline that are taken out of it, and the fuel oil that is left.

"Yes, oil is great business in Texas where the industry controls state government.

"Raise the tuition of the kids working their way through college 100 per cent, but don't take an extra penny from the billionaire oil companies.

"That's Austin's policy."

Editorial in the El Paso Herald-Post, a Scripps-Howard newspaper.

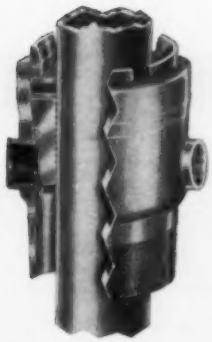


Fig. 91

Simplicity and compactness, for ease of installation and neatness of hookup, are incorporated into the Larkin Casing Head (2000 psi test, 1000 psi working pressure). It is designed to provide a safe and economical means of suspending and packing off casing strings. This head has been tested to support 225,000 lbs., equivalent to 5600' of 7" 20-lb. casing with a safety factor of 2.

DEPENDABLE . . .

ECONOMICAL . . .

VERSATILE . . .

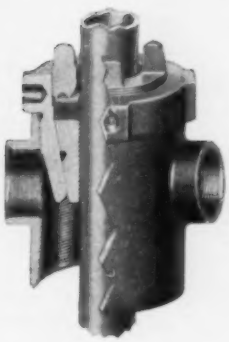
LARKIN CASING HEADS AND TUBING HEADS

For Wells of Medium Depths and Pressure

For detailed information on these and other Larkin Tubing and Casing Heads, please refer to your Larkin Catalog or talk to your Larkin Representative. All Larkin Equipment is available through your supply store.

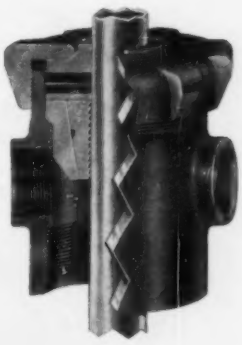
Type L

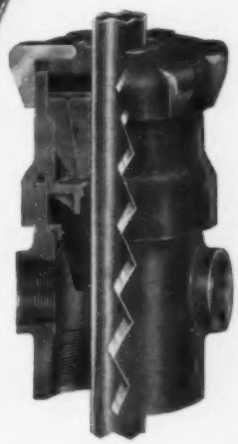
A new member of the Larkin Well Head Line, the Type L Tubing Head fills a need in low pressure areas where economy may be effected with complete safety. It is forged steel construction, full opening, 2000 lb. psi, top of body threaded 7" API to accommodate control equipment, hinged three-segment slips, 2" or 3" side outlets.



Type R

The Larkin Type R Tubing Head is a conversion from the Type SR Head. This ease of conversion makes it possible to use the same stripper adapter and Neoprene stripper when working on any well equipped with a Larkin Tubing Head.





Type SR

The Larkin Type SR Tubing Head is a slip suspension head, equipped with a Neoprene Stripper which serves as a blow-out preventer and oil saver while tubing is being pulled or run. It is very suitable where higher pressures might be encountered.

LARKIN PACKER COMPANY, INC.

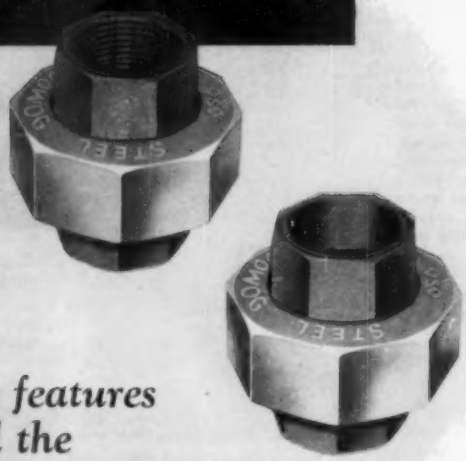
WAXAHACHIE, TEXAS

LARKIN ...Through Your Supply Store

PESA

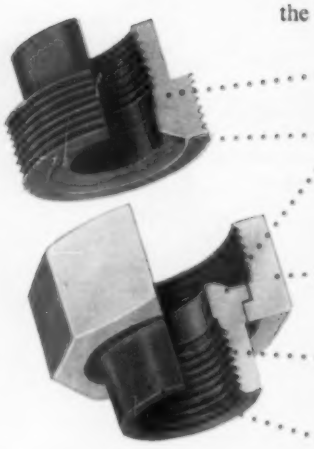
LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

W-S Forged Steel Unions



. . . these features tell the difference . . .

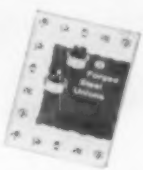
Not all forged steel fittings are alike. Careful design and precision manufacture give W-S Forged Steel Unions these important features that tell the difference:



1. Designed to AAR dimensional specifications.
2. Steel-to-steel seats, with spherical-to-angle mating surfaces. Angle is rolled to extra hardness to resist galling.
3. Cadmium plated nuts for resistance to corrosion and to galling and siezing.
4. End pieces protected against rust by new W-S blue synthetic coating.
5. Octagonal end pieces for better gripping.

W-S Unions are machined from forged steel in accordance with ASTM material specifications A-105, Grade 2. They are available with screw-end and socket-welding end pieces in 3000 lb. class, sizes ⅛″ to 3″.

For complete information send for Bulletin U-1. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.



H. K. PORTER COMPANY, INC.

W-S FITTINGS DIVISION

CALENDAR

OCTOBER

7-9 American Gas Association, annual convention, Kiel Auditorium, St. Louis.

7-11 American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago.

10-11 California Natural Gasoline Association, thirty-second annual fall meeting, Huntington-Sheraton Hotel, Pasadena.

10-12 American Society of Mechanical Engineers, American Institute of Mining, Metallurgical & Petroleum Engineers, fuels conference, Chateau Frontenac, Quebec.

10-13 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

13-15 American Association of Oilwell Drilling Contractors, seventeenth annual meeting, Mayo Hotel, Tulsa.

13-19 OIL PROGRESS WEEK.

15-16 Gas Measurement Institute, sponsored by the University of Kansas, American Legion Hall, Liberal, Kans.

16-17 South Dakota Independent Oil Men's Association, convention, Alonzo Ward Hotel, Aberdeen, S. D.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southern California petroleum section, fall meeting, Biltmore Hotel, Los Angeles.

17-18 Abilene, Tex., Geological Society; Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, Abilene chapter; West Central Texas Oil and Gas Association; and McMurry College, second annual petroleum conference on new developments and applications in log interpretation techniques, McMurry College, Abilene, Tex.

17-19 Four Corners Geological Society, second field conference, Gallup, N. M.

18 American Institute of Chemical Engineers, South Texas section, twelfth annual technical meeting, Moody Convention Center, Galveston, Tex.

20-22 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Peabody, Memphis.

23-25 National Association of Corrosion Engineers, western region, seventh annual conference, U S. Grant Hotel, San Diego, Calif.

23-25 National Association of Corrosion Engineers, seventh biennial Permian basin corrosion tour, Lincoln Hotel, Odessa, Tex.

24-25 Rocky Mountain Oil and Gas Association, midyear meeting, Northern Hotel, Billings, Mont.

24-25 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

25 Natural Gasoline Association of America, southern regional meeting, Washington-Youree and Captain Shreve Hotels, Shreveport.

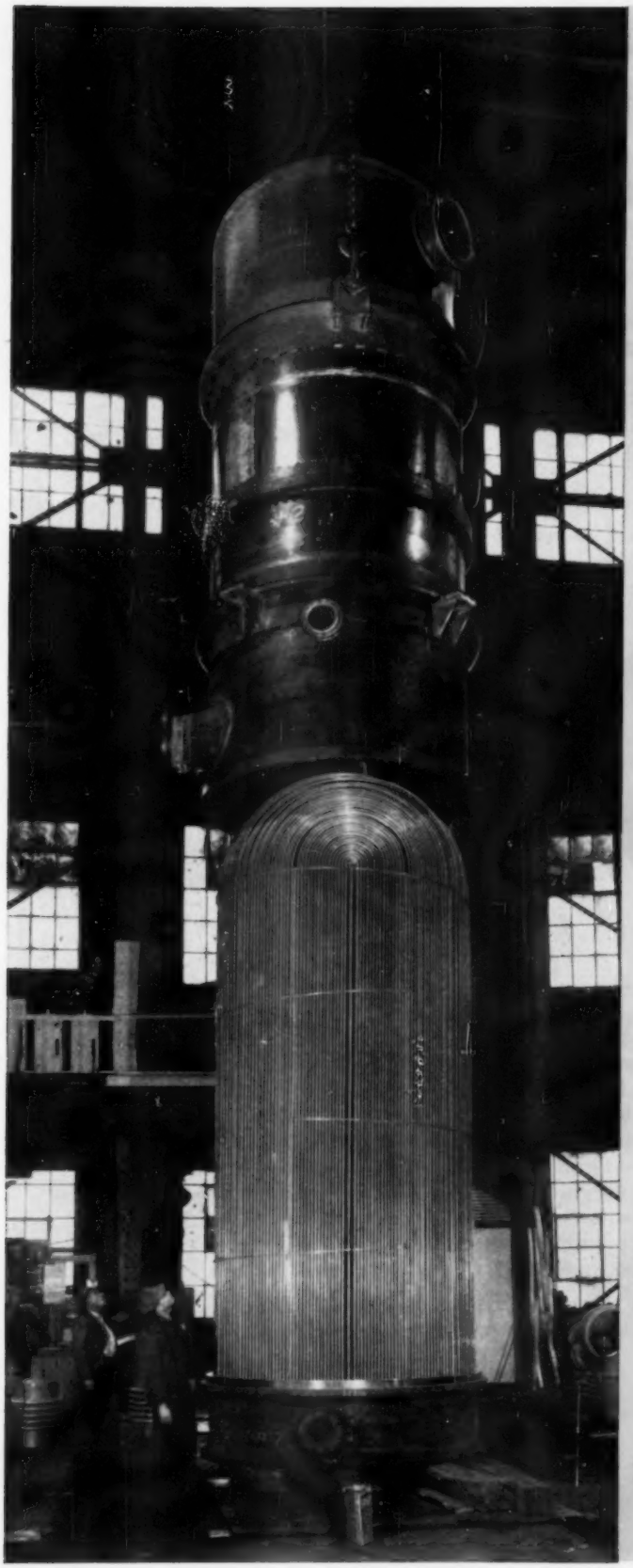
25-26 Abilene, Tex., Geological Society, Fort Worth Geological Society, joint field trip, San Saba County, Texas.

25-26 West Texas Geological Society, fall field trip, Glass Mountains area, Holland Hotel, Alpine, Tex.

27-29 Independent Petroleum Association of America, annual membership meeting, Statler Hilton Hotel, Dallas.

28-30 National Lubricating Grease Institute, twenty-fifth annual meeting, Edgewater Beach Hotel, Chicago.

31-Nov. 1 American Association of Petroleum



YUBA

A GREAT NEW NAME IN HEAT EXCHANGERS

▶ The name YUBA now appearing on heat exchangers all over the country is new. But the plants in Pennsylvania, New York and California which make YUBA heat exchangers are old in experience. Some have been designing and manufacturing heat transfer equipment for more than half a century.

For example, the YUBA Heat Transfer Division was formerly the Heat Exchanger Division of the world-famous Lummus Company; the Calsteel Division has established its own well-recognized name in the West; and the Adsco Division includes the former Alberger Heater Company.

YUBA's experience is, therefore, YUBA's assurance to its customers that the heat exchangers they order are expertly designed for required operating pressures and temperatures and for maximum heat transfer.

Take, for instance, the mammoth exchanger shown at the left, one of four built at the Buffalo Plant. The customer asked for a corrosion-resistant exchanger with tremendous capacity for a secret process. YUBA built this giant which weighs 50 tons, has 12¼ miles of tubing with 14,000 sq. ft. of heat transfer surface. The welding of the 16-ton copper silicon shell attracted industry-wide attention.

Consult YUBA when ordering heat exchangers and benefit from YUBA's vast experience and East-West facilities.

YUBA

CONSOLIDATED INDUSTRIES, INC.
New York Sales Office: 530 Fifth Avenue
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California Steel Products Division, Richmond, Cal.
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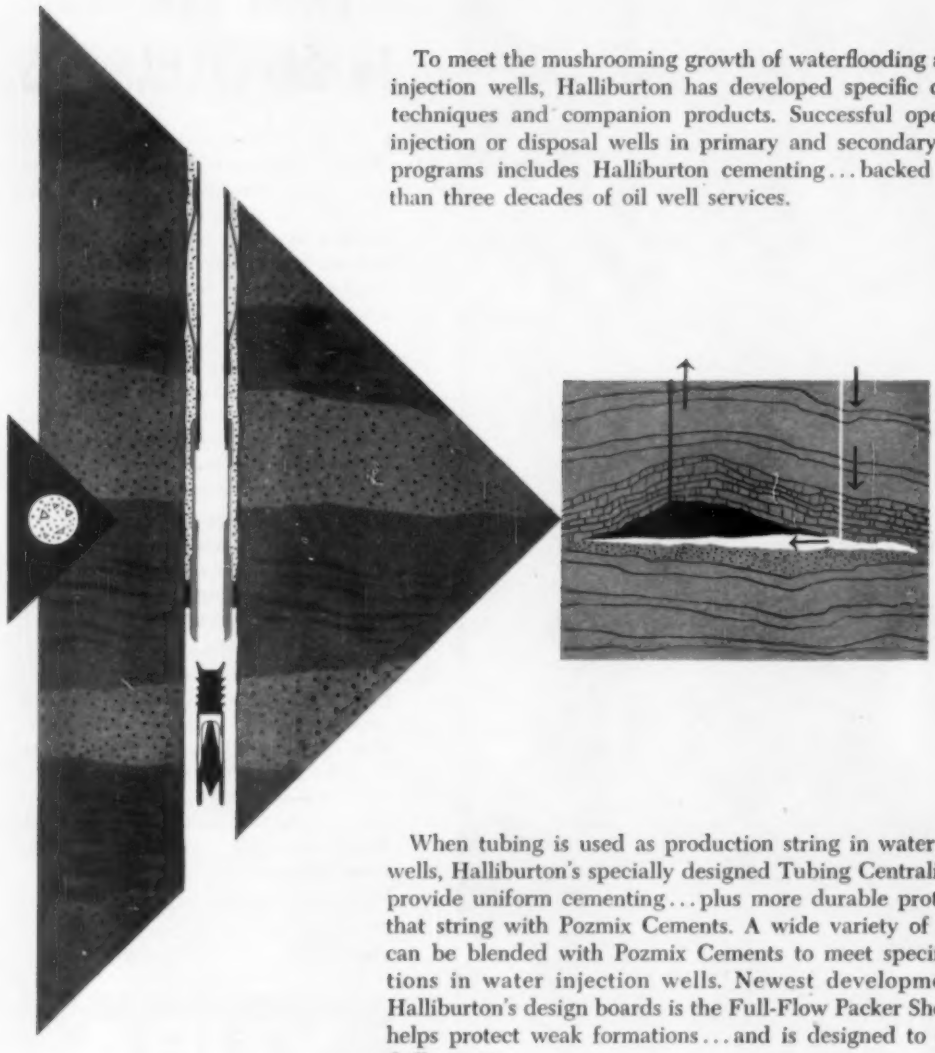
WHY HALLIBURTON CEMENTING IS BEST FOR water injection wells!



To meet the mushrooming growth of waterflooding and water injection wells, Halliburton has developed specific cementing techniques and companion products. Successful operation of injection or disposal wells in primary and secondary recovery programs includes Halliburton cementing... backed by more than three decades of oil well services.

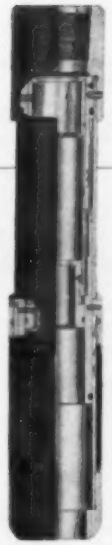
When tubing is used as production string in water injection wells, Halliburton's specially designed Tubing Centralizers help provide uniform cementing... plus more durable protection of that string with Pozmix Cements. A wide variety of additives can be blended with Pozmix Cements to meet specific conditions in water injection wells. Newest development from Halliburton's design boards is the Full-Flow Packer Shoe, which helps protect weak formations... and is designed to eliminate drill-out time.

For the most advanced services... call the world's most experienced oil well cementing company.

HALLIBURTON
OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

BETTER TOOLS TO DO A BETTER JOB

NEW FULL-FLOW PACKER SHOE designed to eliminate cement drill-out



New Full-Flow Packer Shoe

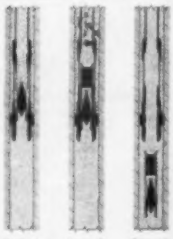


Fig. 1 Fig. 2 Fig. 3

Fig. 1 — Ports open, displacing cement.

Fig. 2 — Cement in place, closing plug seated closing ports.

Fig. 3 — Plug, seats and bomb discharged out of shoe.

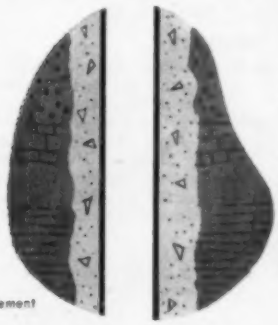
...A packer-type cementing shoe to help protect the formation below while cementing tubing or casing in new or old cased or uncased wells. No internal parts remain in the string to be drilled out after cementing. Seats and cementing plugs are discharged out of the bottom of the shoe into the open hole.

- For protection of weak formation while cementing tubing or casing in oil, gas or water injection wells.
- For fracture or treatment of old wells to improve production... the tubing or casing is first cemented, then well is fractured.
- For plugging back or killing wells having excessive bottom pressure. Packer is set and cemented in regular manner, with tubing left open for pressure to escape until cementing material has set. Then, well is squeezed, tubing is backed off and well is killed.
- For wells where Halliburton Formation Packer Shoe cannot be used because formation water pressure below packer is greater than hydrostatic head of cement around the outside of the casing.

Tubing Centralizer

TUBING CENTRALIZERS

...are used on tubing strings in deep wells to help protect tubing and collars against wear when the string is frequently pulled and then re-run. In some areas, tubing is used as production string and for water injection wells; centralizers give better centering in the bore hole and allow for better placement of cement around the tubing string. Tubing centralizers are also used on strings for protection of flow valves (gas lift).



Pozmix Cement

HALLIBURTON POZMIX CEMENT

...is a blend of pozzolanic materials and portland cement, with desirable characteristics that cannot be obtained with neat portland slurries. Such features as resistance to corrosive well fluids, improved perforating qualities and reduced gelling action during displacement make Halliburton Pozmix Cement superior to portland cement for many applications.

HALLIBURTON BULK CEMENT ACCELERATORS

...Calcium Chloride adds to the early compressive strength of cement, reduces W. O. C. time, and is an effective "accelerator" for all types of cementing compositions.

...Diacel A is used with Diacel D cement to accelerate the set where low water loss additive is used in primary and remedial cementing at low temperatures.

A Halliburton Field Service Representative is available to help you plan any cementing job.

CEMENTING SERVICES

"A WELL WORTH CEMENTING IS WORTH CEMENTING WELL"

DEPENDABLE,

ACCURATE,

CHEMICAL METERING.

MANZEL CHEMICAL FEEDERS are simple in design, ruggedly-built, unfailingly accurate. Fully adjustable for metering any desired amount of liquid from 0 to 1 gallon per minute. Our experienced field engineers are at your service.

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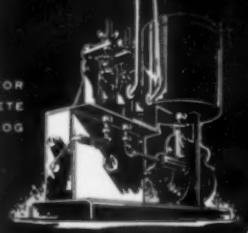

Manzel

LUBRICATORS • CHEMICAL FEEDERS • SLURRY PUMPS

BABCOCK STREET • BUFFALO 10, NEW YORK

A Division of Houdaille Industries, Inc.

Geologists, Mid-Continent regional meeting, Education Building, Fairgrounds, Tulsa.

NOVEMBER

3-8 Society for Nondestructive Testing, second international conference, Hotel Morrison, Chicago.

6-8 Gulf Coast Association of Geological Societies, seventh annual convention, Roosevelt Hotel, New Orleans.

6-8 Society of Automotive Engineers, national fuels and lubricants meeting, Hotel Statler, Cleveland.

11-14 Society of Exploration Geophysicists, twenty-seventh annual meeting, Statler-Hilton Hotel, Dallas.

11-14 American Petroleum Institute, thirty-seventh annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-14 National Association of Corrosion Engineers, northwest region fall meeting, Penn-Sheraton Hotel, Pittsburgh.

22 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Tulsa.

1-6 American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York.

2-6 Twenty-sixth Exposition of Chemical Industries, Coliseum, New York.

8-11 American Institute of Chemical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

JANUARY

16-18 Association of Oilwell Servicing Contractors, second annual convention, Baker Hotel, Dallas.

19-22 Pipe Line Contractors Association, tenth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

31 Natural Gasoline Association of America, regional meeting, Skirvin Hotel, Oklahoma City.

FEBRUARY

16-20 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Hotel Statler, New York.

26-28 American Petroleum Institute, Division of Production, southern district meeting, Shamrock-Hilton Hotel, Houston.

28 Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Tex.

MARCH

3-4 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fourth annual joint meeting of Rocky Mountain petroleum sections, Cosmopolitan Hotel, Denver.

5-6 Gas Conditioning conference, sponsored by the University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla.

7 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.

12-14 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Texas, Fort Worth.

17-21 National Association of Corrosion Engineers, annual conference, civic auditorium, San Francisco.

24-26 Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo.

31-April 2 American Petroleum Institute, Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans.

With Magcobar on your well ...

you are on your way to a better cementing job

The biggest savings a good mud program brings you come from the difficulties and unnecessary expenses which are *avoided*. These savings don't show up in the mud bill. But in total cost, yes.

If you ran casing on schedule with no sticking, no bridging, you can be sure the mud and the hole were in proper condition. You saved again if your mud had the right gel characteristics for cementing, helping to prevent channeling. And, if after perforating, you found a good cement job with no communication between zones, you have avoided an expensive squeeze job. You saved, too, if hole was close to gauge, resulting in proper cement fill-up the first time.

When the mud is planned right and prepared right for each foot of hole, the cost of drilling each foot is reduced. And when the Magcobar team is working and planning with you, you get the industry's best qualified mud engineers, the best drilling muds and chemicals—at your well when you need them. To be sure Magcobar is on your next well, start planning with Magcobar now.

Magnet Cove Barium Corporation
Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

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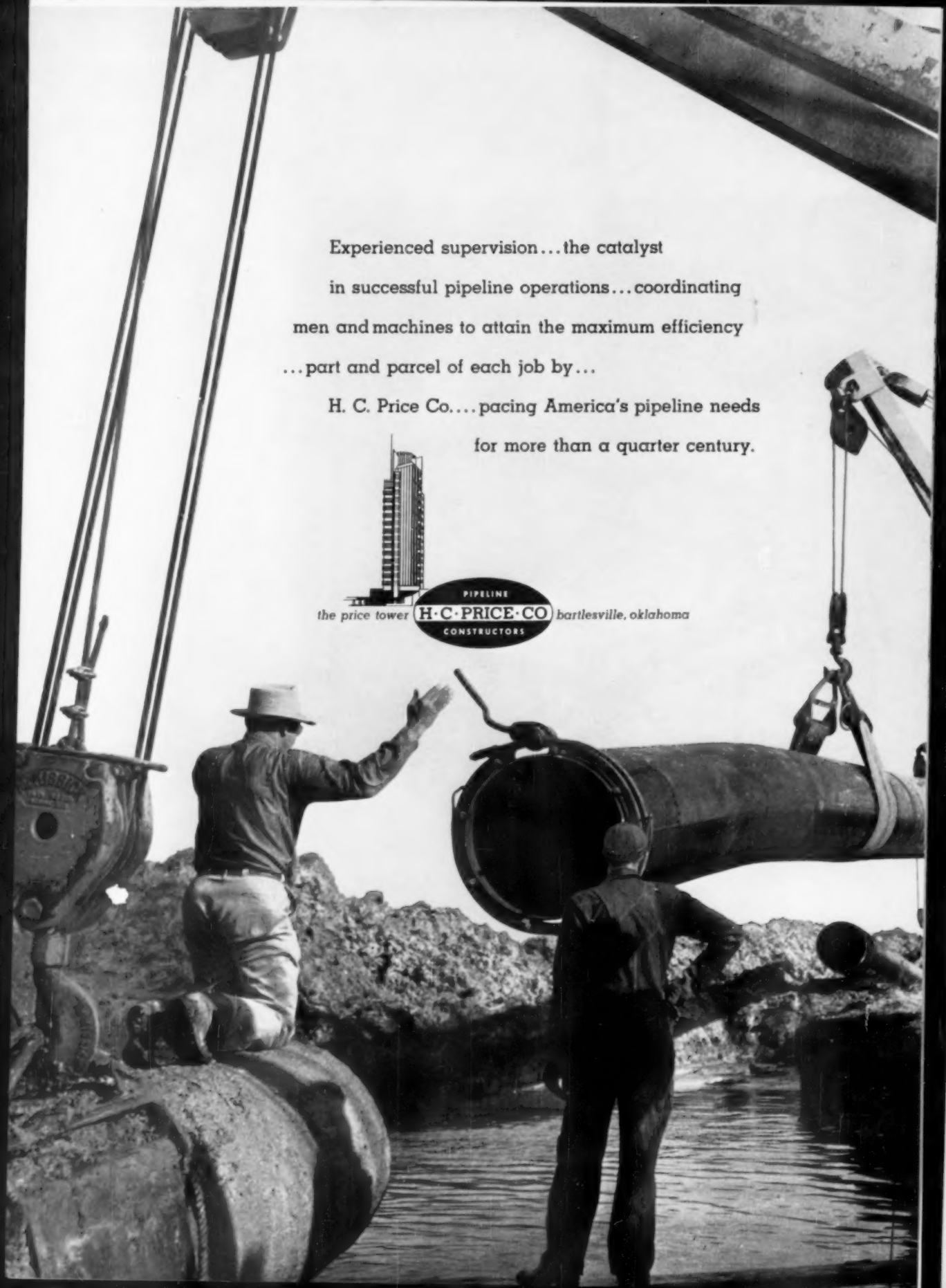
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men and machines to attain the maximum efficiency
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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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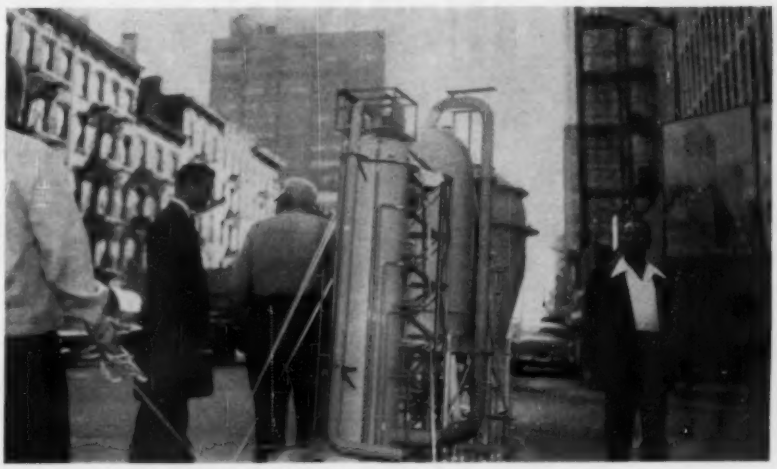
JOURNALLY SPEAKING



Bachelor and Model

LADY GODIVA would get little more than a passing glance if she performed her publicity stunt today on busy Fifth Avenue. And if she made the trip again on horseback, it's altogether possible the horse would get the biggest tumble.

Such is the reputation, at least, of the blase dwellers of fabulous Manhattan. You'd hardly expect, then, that a bachelor escorting a model down Third Avenue would have much curiosity value.

But the model in this story is the one in the photo. And nobody knew what reaction to expect.

The model is of a giant, 90,000-bbl. fluid cat cracker which M. W. Kellogg Co. is erecting for The Texas Co. at Port Arthur. And the bachelor, at left with dispatch case, is the Journal's own New York advertising representative, John Sherwin.

The Journal borrowed the model to exhibit at a meeting in the Waldorf Astoria. It was John's job to pick it up at Kellogg's offices in the tall building in the background and accompany it to the Waldorf, 5 blocks away.

John was discomfited at the outset to find the unit wouldn't go through any of Kellogg's doors. Things were a little frustrating until Kellogg Ad Manager Art Dowling found a back exit that was big enough and John hit the street with his oversized "date."

Since Sherwin is one of the more blase of the big-city fo ks, it didn't surprise him much that, sure enough, few citizens gave the thing a second look. But the lack of interest bothered Refining Editor George Weber, who finds such models not only glamorous, but fascinating. After all, says Weber, this is a side-by-side type cracker, and the model is made of plastic and is coded. Besides that, it's functional.

The model was put together as the big unit was designed so that designers could "see" what they were doing. It did away with a lot of piping drawings, guaranteed there should be plenty of materials-handling space for maintenance and turnarounds. Such a mode , says George, guides the contractor during construction and, when the big unit is nearly finished, the process folks can use it in their training programs before operations begin.

And for the benefit of interested refiners, George points out that from front to back, the units are the main fractionator, the reactor, and the regenerator.

The man in the street may have been oblivious, but satisfaction for George came later. The Journal's customers at the Waldorf couldn't look at the model enough. "It was the focal point in the cocktail lounge before lunch, and everyone crowded around to take a look," beamed George.

Other refiners may share his excitement, but, after all, wouldn't that have happened to any model?

—Ted Armstrong.

DON'T STAY IN THE DARK...

TO WARREN *for:* **QUALITY QUANTITY SERVICE**

Whatever the GRADE and the VOLUME of

NATURAL GASOLINE

Just rely on WARREN'S versatile facilities to give you dependable deliveries . . . WHERE and WHEN and the WAY *You* want them.

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Speak your piece then get to work

NOT IN THE LAST 10 years has the oil industry's public-relations program been so wide open for comment.

The far-flung Oil Information Committee is now without a permanent director. Too, the agency's aims, policies, and its organization are now being questioned. Top executives within OIC are studying a report prepared by an A.P.I. committee appointed to survey the entire operation, to evaluate its results, to weigh its efficiency, and to recommend needed changes.

As a further check on its program, the OIC last week was preparing to take another public-opinion poll to see whether the average citizen's opinion of the industry has changed. Several weeks, and perhaps months, will pass before the A.P.I.'s top officials decide whether to continue OIC in its present form, to reorganize its staff, to redirect its course.

THIS STATE OF FLUX comes at a time when the oil industry's interest in public relations is at a peak. When the program was started 11 years ago there was little concern in the oil industry's grass roots. But the last year and a half has seen public relations rise to a position of prominence as one of the industry's greatest problems.

This is a healthy coincidence. At a time when the average oil man's concern is greatest, there approaches a time of decision on the future of this industry-wide program. It's an opportunity for every oil man to speak his piece, to contribute his ideas on the problems of greatest moment and the means to their solution. From these might well come a new course and new life for this experienced agency.

BUT NO MATTER what direction the efforts of the "new" OIC might take, oil men should remember that the OIC is just one tool. The responsibility for the oil industry's reputation still rests, and always will rest, with the individual oil man.

The desperate need today is for each oil man to realize that what the public thinks—and therefore what Congress thinks—is a matter of direct personal concern to him.

If there is any doubt, he need only look ahead to the convening of Congress in January. There will be a new and well-organized attack on percentage depletion. There will be new pressure on Congress to prod the federal Government into the oil industry through the medium of imports control. The Harris bill—possibly the last chance to wrest the gas industry from federal domination—will be up for its ultimate decision. And this is far from all.

Even a perfect solution to the problems of the OIC would be of little help in the critical weeks ahead. It should be obvious that the individual oil man has his job cut out for him. And if the industry is to come out no more hamstrung than it already is, the job won't permit delay.

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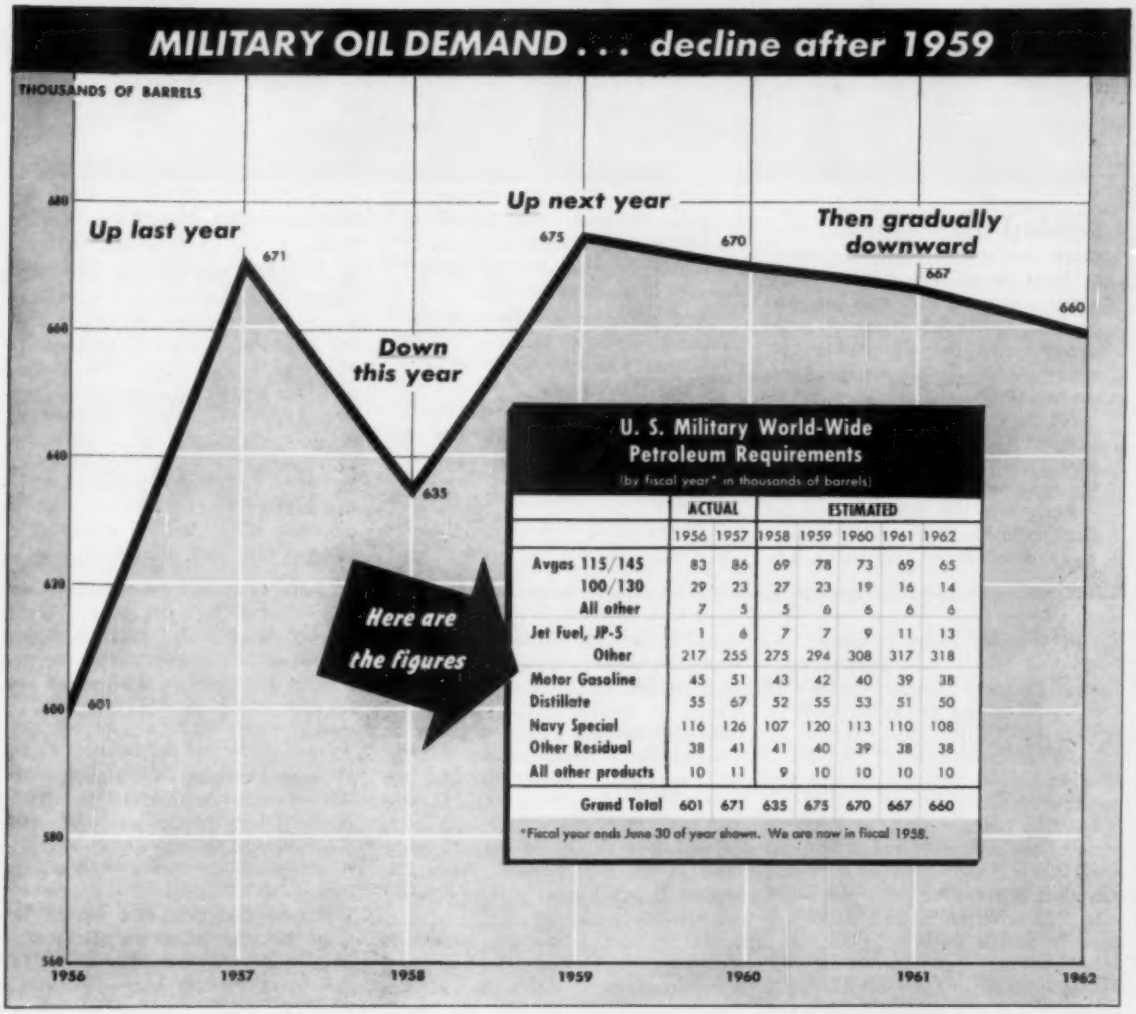


U. S. Military World-Wide Petroleum Requirements

(by fiscal year* in thousands of barrels)

	ACTUAL		ESTIMATED				
	1956	1957	1958	1959	1960	1961	1962
Avgas 115/145	83	86	69	78	73	69	65
100/130	29	23	27	23	19	16	14
All other	7	5	5	6	6	6	6
Jet Fuel, JP-5	1	6	7	7	9	11	13
Other	217	255	275	294	308	317	318
Motor Gasoline	45	51	43	42	40	39	38
Distillate	55	67	52	55	53	51	50
Navy Special	116	126	107	120	113	110	108
Other Residual	38	41	41	40	39	38	38
All other products	10	11	9	10	10	10	10
Grand Total	601	671	635	675	670	667	660

*Fiscal year ends June 30 of year shown. We are now in fiscal 1958.

How Military Sees Future Oil Needs

MILITARY purchasers are caught at the moment between budget ceilings imposed by Congress and rising prices for materials. This squeeze is forcing a cutback in volume of petroleum products bought.

In longer range, some petroleum products eventually will be supplanted by other energy sources, although the timing and degree cannot be estimated yet.

These are conclusions reached by the nation's top military planners and disclosed in an exclusive interview with The Oil and Gas Journal.

Pentagon officials, while confirming the gradual decline, add quickly that the bottom is not falling out of the military market. Far from it. Transport planes, for example, will be around for a long time.

The estimated decline foreseen today is gradual. Moreover, the projection represents a minimum estimate of need. Unforeseen factors could boost it appreciably.

Total military fuel needs will drop more than 5 per cent this current fiscal year (1958). But this is a temporary departure. Next year's buying will more than offset this economy slice.

But next year may well be the

Behind the story: For years government policy has been to keep its military buying plans secret. But present officials believe it's to the advantage of both industry and the Government to outline openly the future needs of the military.

So, here, for the first time, are firm estimates for the next 5 years, plus some factors which will influence demand long after that.

Figures in the story do not reflect inflated requirements which would result from "incidents" calling for unusual deployment of forces nor the demand in event of war. They presume no major change in world conditions.

The photo shows Defense and Interior officials meeting in the Pentagon with two editors of The Oil and Gas Journal. The officials supplied the table on the preceding page. Information in the story on these pages grew out of the conference and from other data assembled.

In the photo, left to right: Herbert Blair and Charles Primoff, petroleum specialists, and Capt. W. E. Oliver, USN, all from the Office of Assistant Secretary of Defense (Supply and Logistics); Frederick S. Lott, assistant director, Office of Oil and Gas, Interior Department; Maj. Gen. L. E. Cotulla, USA, staff director, Petroleum Logistics division, Office of Assistant Secretary of Defense (Supply and Logistics); George H. Weber, refining editor, and John P. O'Donnell, district editor, both of The Oil and Gas Journal; and H. J. Barton, Office of Oil and Gas, Interior Department.

biggest year for many to come, unless world events alter present conditions. Thereafter, annual declines of 1 per cent or less are in prospect to July 1, 1962.

Valid estimates cannot be made after that. But officials expect the moderate downward trend to continue. Long-range factors such as development of missiles and atomic-powered naval vessels are expected to speed the fall in demand for petroleum products. But how much, and when, are question marks today.

The jet picture . . . More than 44 per cent of this year's military buying will be for jet fuels, now averaging 282,000 bbl. per day. By fiscal 1962, the jet-fuel requirement will have risen to 331,000 bbl. per day and represent fully half of all military needs.

While both kerosine and gasoline types of jet fuel will share in this rising demand, kerosine will grow faster. Today the proportion of the lighter gasoline-type fuels to kerosine-type or JP-5 is 40 to 1. In 1962 it will be 25 to 1.

What about 1965 or 1975? Too many factors are involved to allow a clear picture of jet-fuel requirements beyond the next 5 years. The consensus seems to be that military demand for jet fuel will continue roughly at the 330,000-bbl. per day level through 1965.

Effect of missiles . . . The tempo of the missile program makes it difficult to project jet-fuel demand beyond 1962. Substitution of missiles for both short-range and long-range piloted aircraft is anticipated some time in the next decade. When this occurs, it could upset jet fuel demand materially.

But without a timetable on missile development, the jet-fuel consumption curve must remain essentially a plateau of about 330,000 bbl. per day indefinitely.

The first inroads will be made by the medium-range ballistic missiles (MRBM) on the interceptor-type jet plane. Eventually, the intercontinental type (ICBM) will become a fully developed military arm ready for mass production.

When that day arrives, the huge quantities of fuel used to train pilots and keep them flying on tactical missions no longer will be required. This transition will not come with a rush, but it will eliminate much of today's fuel consumption.

The new missiles will require only one fueling. And test flights will be limited because the missile itself is destroyed in the test. While manned aircraft will continue in transport use, the remaining market will tend to shrink.

JP specs changing . . . Tighter specifications are coming. Higher flying means lower freeze points. JP-5 requisitions now ask for a —55° F. freeze point, compared with the recent —40° F. spec.

Engine designers also would like a higher end point. In the jet-fuel pool, end points are rising along with the trend toward more JP-5 kerosine-type fuels. Commercial interest in kerosine-type fuels could cause a further restriction.

Military engineers realize these two specifications are conflicting and will require more processing. The engineers concede they must compromise because of availability and cost. But refiners can expect some tightening in specifications on freezing point and end point.

Another change coming is a limiting specification on thermal stability of jet fuels. Today this characteristic, as measured in the Erdco coker, is reported but is not limiting.

The limit today on mercaptan sulfur is 0.005 per cent. Tomorrow, if

indications are correct, it may be 0.001.

These trends warn that more processing depth is needed. Refiners without hydrogen treating or similar facilities may lose out to those with more modern plants.

But defense officials do not believe these narrower specifications will reduce availability seriously. They describe the oil industry as being "without parallel in flexibility." In short, the industry has provided what is wanted, where it is wanted, and when. They believe it will continue to give this service.

The exotic fuels . . . The higher energy fuels based on boron and other elements are still too costly for use in manned aircraft.

It is still too early to judge whether the cost of these so-called exotic fuels can be reduced to a point where they will become competitive some day with conventional jet fuels.

Some forecasters predict this will occur in the extended future, but military buyers cannot weigh its possibility at present. It is conceded, however, that solid propellants for piloted aircraft may be in the military picture by 1975.

Decline in gasolines . . . Aviation gasoline has been second to jet fuel in armed services requirements. But last year it dropped to third place on a volume basis behind Navy special fuel oil.

Jet-fuel requirements now double those for all grades of aviation gasoline, and within a few years the requirements will be fourfold.

But the demand for avgas will not drop abruptly. It will continue along a gradually declining trend, even though the Air Force has ordered its last tactical piston plane. Piston planes still will be in service for some time to come, as evidenced by the military's 85,000-bbl. per day estimate of demand for 1962.

Alkylate needs will decline less than will the demand for total avgas. Top grades which contain more alkylate will taper off in demand less rapidly than the lower octane grades. No changes in specifications for aviation gasoline are anticipated.

Motor gasoline demand is off sharply in this economy year. But the longer range demand to 1962 shows a very gradual shaving of consumption. This does not reflect any planned deemphasis of ground forces. Instead, it reflects an expectation that all products, including fuel and oil, will cost more during the next 5 years. This inflation, with a budget ceiling, will force a cut in buying.

No drastic revision of motor gasoline octane is seen. Federal specs today call for 83-91 octane gasoline, which is satisfactory for routine military equipment.

Military buyers are fully aware they can buy 100-octane gasoline generally in a short time. But they resist following the trend to higher quality because of the need to standardize on fuel grades.

They must be able to make available quickly, throughout the world, a vast quantity of fuel. This limits the number of grades of any single fuel which can be handled efficiently and economically.

Motor gasoline demand this fiscal year will average 43,000 bbl. per day. By 1962 it is expected to drop to 38,000 bbl. per day. Compared with the peak year of fiscal 1957, this is a drop of 25 per cent.

Distillate demand is off sharply. Demand this year will be 52,000 bbl. daily, or 20 per cent under the fiscal year which ended June 30. Demand will rebound next fiscal year and then show a gradual decline to about 50,000 bbl. per day in 1962-63.

The Navy demand . . . Navy special fuel oil follows the downward trend in consumption this year. The cut is 20 per cent. As with other fuels, it will rise again next year and then decline slowly until 1962 to a level roughly equal to the present one.

By that time the Navy's current nuclear program will be nearly complete. The program consists at present of 19 submarines, one aircraft carrier, and one cruiser. The number is still relatively small in proportion to today's active fleet of the same types of ships. The active fleet has 117 subs, 23 carriers, and 17 cruisers.

Navy Sec. Thomas S. Gates recently described to the National Petroleum Association the extent of the Navy's nuclear program. Gates said the present program will be completed by 1962 but that "it will be a long time before oil is displaced in the ships of the Navy."

"We are proceeding as fast as our resources will permit to replace our aging fleet with nuclear-powered ships," he said. But, he added: "It would be uneconomical to convert our old ships to it."

Gates told the N.P.A. the Nautilus steamed 62,562 miles, more than half of them submerged, on one charge of uranium. To duplicate it, a diesel-powered submarine the size of the Nautilus would have needed more than 2,000,000 gal. of fuel oil and had to refuel more than 20 times.

Other residual fuel is used primarily for permanent military installations, and little change is anticipated in the demand.

Rest of the picture . . . Demand for other petroleum products, except for lubricating oils, is expected to remain firm.

Petroleum-based lubes gradually are giving way to synthetics, and this trend will continue. The change should be marked next year and, by 1962, synthetic products may supply half the Air Force's needs for jet lubes. Synthetics now are being used in reciprocating engines, and the Air Force is recommending their use.

Except for nuclear power for Naval ships and possibly solid fuels for missiles and jets, the type of fuels required by the armed services should not change greatly.

The gas turbine, which could create a big demand for kerosine-type fuels, apparently has met with as little success in military use as in civilian.

While no great changes are anticipated in the types of fuel the military will use, the consumption per unit will rise steadily. This factor, combined with the higher cost of material, complicates the purchasing problem of the armed services.

Overseas buying . . . Most military petroleum purchases are made in this country.

The military, however, buys about 147,000 bbl. of petroleum products per day from overseas sources for overseas use, or just over 23 per cent of its entire petroleum requirements.

With bases all over the world, the importance of being able to obtain products from convenient sources is apparent. It is important also to have an assured variety of overseas sources in time of crisis, and the only way to accomplish this is to establish these sources during peacetime.

The major overseas petroleum purchased is residual fuel, mostly for bunkering Naval ships. The residual fuel total is expected to hit 62,000 bbl. per day, or more than 40 per cent of all overseas buying.

Other significant purchases overseas are 33,000 bbl. per day of jet fuel, 23,000 bbl. of motor gasoline, and 22,000 bbl. of distillate.

The Military Sea Transport Service handles most of the transport of overseas petroleum. MSTS operates a number of tankers as well as cargo vessels. It can readily handle normal requirements but in an emergency may have to go into the spot market for transport service. When it does, military transport is subject to the same rate hazards faced by commercial firms.

Sohio Proposes Huge Spraberry Flood

- **100-section flood is visualized, with payout in as little as 1½ years**
- **Initial plan calls for nine-section unit to be flooded immediately**

MIDLAND, Tex.—Sohio Petroleum Co. has launched a drive to gain operator support in sprawling Spraberry Trend Area field for what may become the world's largest unitized water flood.

Late last month, 46 Spraberry operators controlling more than 75 per cent of the huge field's production assembled here to listen to Sohio's proposals.

Sohio acted after studying thoroughly data made available to it by Humble Oil & Refining Co. and Atlantic Refining Co. on their pilot floods in the Spraberry.

The company made its own analysis of the results of these pilots. This is what it concluded and passed on to the 46 operators in Midland:

... **Spraberry can be flooded,** and:

... **It can be quite profitable** with perhaps as much as $20 return for each $1 invested in flood facilities, but:

... **It must be done soon,** within a year at the most, otherwise too many wells now producing will reach the economic limit and be abandoned. All existing wells are needed, because:

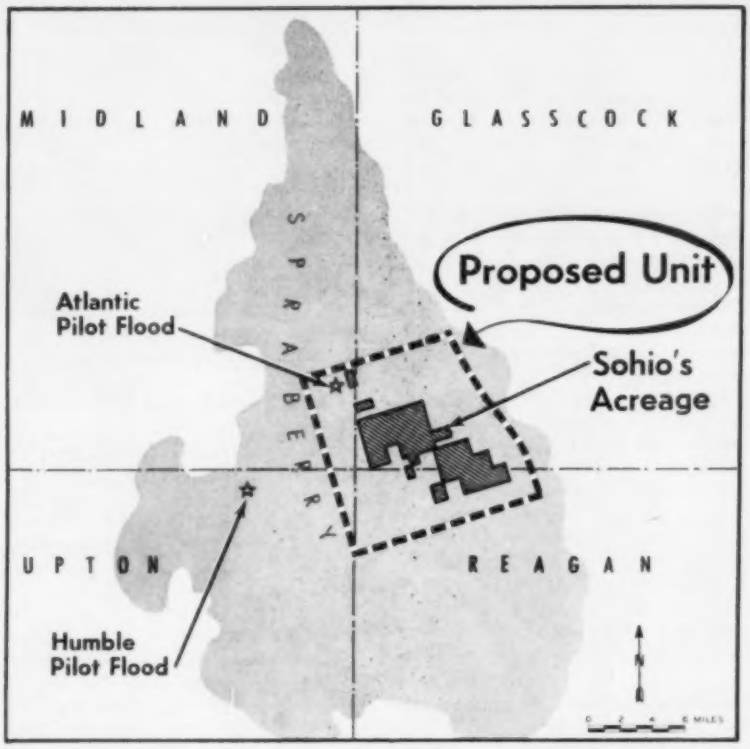
... **Flood economics are such** in the Spraberry that a project likely will be feasible in only the more fully developed areas of the field—not in those where considerable new drilling would be necessary. Also:

... **Injection rate must be high** enough to restore field pressure and reopen Spraberry fractures near producing wells. And this means:

... **Flood must be big.** Otherwise high water input rate would result in too-heavy water leakage to areas outside the unit.

Sohio's plan . . . On this basis, Sohio is proposing a whopping unit and flood of up to 64,000 acres surrounding its big acreage spread in the Driver area of the east central part of the field.

This compares with 50,000 acres in the present world's biggest unitized flood — the SACROC operation in Kelly-Snyder field.



The company said it was willing, because of its acreage position, to direct the unitization effort and conduct the water flood as unit operator.

It thinks the unit should be held to a maximum of 100 sections, or 64,000 acres, for two reasons—partly to speed unitization, and partly to avoid too bulky a project with resulting wasted management effort and overhead.

Sohio suggests limiting the flood at first to nine sections and expanding it over the entire unit when the results warrant.

Part of the area which Sohio wants to unitize, unlike that in the Humble and Atlantic floods, has production from both upper and lower Spraberry. Largely because of this complication, the company is proposing straight productive-acreage participation, with each two-zone productive acre valued at 1.5 times a single-zone acre.

The company said a study of cumulative production from a 107-section single-zone area and a 56-section two-zone area was used to arrive at the 1.5 relative value.

The large areas studied, Sohio says, tend to greatly cut the effect of regional drainage, a factor that would be of great importance in a small area. Also, the straight acreage formula avoids "the limitless engineering effort and needless confusion" that would come from weighing and attempting to agree on multiple factors.

Profit estimated . . . Sohio fixes average field-wide primary recovery from the upper Spraberry, the main zone, at roughly 466 bbl. per acre, or from both upper and lower pays at about 700 bbl. an acre.

The 466 bbl. per acre, the company says, is only about 6 to 8 per cent of oil initially in place.

Humble already has recovered more than 105,000 bbl. of oil from its 80-acre five-spot pilot in the upper Spraberry, or about 1,250 bbl. per acre, Sohio says.

Applying the Humble test results to the Driver area, Sohio has come up with an estimated flood recovery in the proposed unit area of 1,875 bbl. per acre, possibly higher.

For a full 64,000-acre area, this would mean a big 120,000,000 bbl. of added oil from the flood.

Sohio figures water supply and distribution facilities will cost about $135,500 per section for a flood using the 160-acre well spacing and 320-acre five-spots.

Most of the area is developed on 160 acres. And Sohio thinks it would be unwise economically to spend the extra $5,000,000 to $10,000,000 to develop just the 9-section pilot on 40 acres.

Wells in the area already on closer spacing would be recompleted as water-supply wells in the San Andres formation.

Profit, based on these estimates, could run as high as $20 for each $1 invested, Sohio thinks. This is before income taxes and discount but after deducting for royalty and state production tax payments.

The amount of profit depends both on total flood oil recovery and rate of production. The $20 profit is foreseen if recovery is comparable to that of the Humble flood at production rates of 50-200 bbl. daily. This, Sohio feels, is extremely good. But profit would still be satisfactory even if the flood should recover only 500 bbl. per acre of added oil.

The flood in the first set of circumstances would pay out in only 1½ to 4 years and project life would be from 15 to 40 years. With only 500 bbl. per acre and same production rate, payout time would be the same but field life would be cut to 7 to 13 years.

How flood will work . . . Sohio pays high praise to Atlantic and Humble for their pioneering flood efforts in Spraberry—where it was once felt that tight pay and fractures were insurmountable bars to flooding.

Atlantic, Sohio thinks, proved that Spraberry could be flooded, with its imbibition field test started in 1952. But most well-production rates in the project were too low to interest other operators in joining in an expansion of the project.

Humble went on step further. It found that, along with imbibition, the Spraberry's billions of small crossfractures (as opposed to the main northeast-southwest fracture pattern) were a big aid to flooding.

The crossfractures provided entry points for flow into the matrix. Under flow conditions, pressure gradients exist across all fractured blocks. And, Humble found, flow will occur in these fractures with significantly short floodout times.

Water enters the water-wet matrix from the crossfractures continuously and continuously forces oil out into the main fracture system.

Humble thus found that water is taken into the matrix and injection rates could be much higher than was formerly thought possible.

Injection rates at the Humble pilot ran three times higher than at the Atlantic flood. The high input rate, Sohio thinks, is the main difference between the two tests and the key to the high-producing rate of the Humble flood.

Sohio deduces that the big reason for the rapid decline in Spraberry production was not due to lack of oil but rather to sand compaction and the closing of fractures as pore space was voided and pressure dropped.

High water input rates have restored reservoir pressure in the Humble pilot area and, Sohio thinks, reopened the all-important fractures.

The history of large fracture treatments in the Spraberry bears this out, the company says. Production rate often was doubled or tripled. But the effect didn't last long because the fractures soon closed again.

Time all-important . . . Sohio thinks it is vital to get the unit under way as soon as possible. It has given itself to the end of next year to get the unit going. If it hasn't succeeded by then, Sohio figures, it will be too late. Too many Spraberry producers will have been abandoned as uneconomic due to fast-falling production.

Spraberry, developed primarily in 1951-52, reached its peak production in September 1952 when it produced 107,171 bbl. a day. By last June it was down to 48,500 bbl. daily. And only 823 wells of a total of 3,107 (including Benedum) made more than 20 bbl. daily on a lease-average basis.

Project must be big . . . Sohio, in its pitch to get the other operators to join it, again used the Humble pilot as the base for its contention that the projected flood must be large.

The flood must be big, it argues, so that peripheral water loss won't be too great, compared to the volume needed for fillup (estimated to take 1 year) and displacement in the flood area.

Humble, Sohio said, lost more than 5,500 bbl. of water daily from its 80-acre pilot on gravity injection. This, plus Sohio's water-flow calculations and interference tests, show that great volumes of water must flow away from any area in the Spraberry if reservoir pressure is restored to 2,000-3,000 psi.

The company figures it would take 30,000 bbl. of water daily to flood the nine-section area during fillup and 10,000 to 20,000 bbl. daily when pressure is restored to 2,000 psi. or higher.

Sohio thinks San Andres zone salt water will be sufficient. In a 1-day test of this zone, a Sohio well produced 12,000 bbl. of water daily with a pressure drawdown of only 45 psi.

Other floods coming . . . Sohio thinks other units will be following soon. It believes it possible and probable that if other operators don't delay unduly, most of Spraberry's more than 300,000 developed acres ultimately will be flooded.

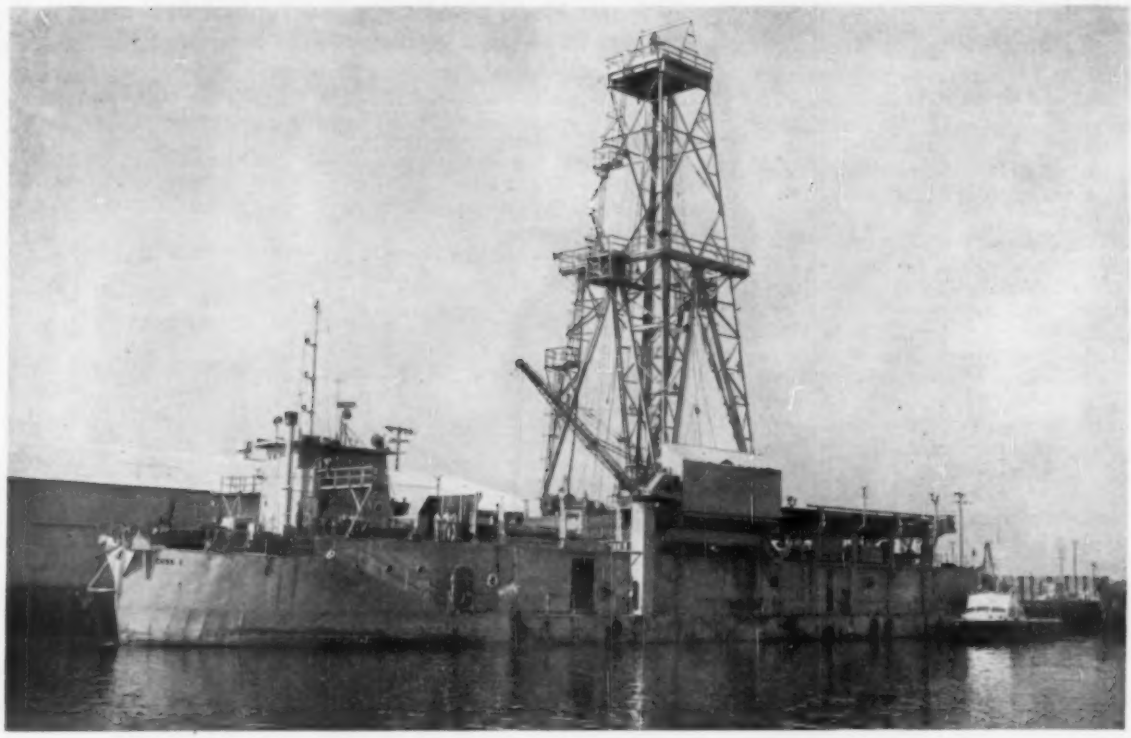
The Journal's findings seem to bear this out (OGJ, Sept. 2, p. 92). Both Sinclair Oil Corp. and Magnolia Petroleum Co. are known to be planning sizable floods.

Sohio thinks a series of cooperative units operating in Spraberry could prove a great boon to operators, royalty owners, and the West Texas region in general. But there must be haste—or Spraberry will yet go down in the books as a graveyard for a staggering amount of oil capital.

Water-Flood Investment for Typical Section

(2 producing wells, 2 injection wells, ½ water-supply well)

	Unit cost	Pro rata share per section
Water supply well (recompletion from Spraberry to San Andres)	$20,000	$10,000
Submersible centrifugal pump, power system, transformer	28,000	14,000
Water distribution system		
Lines, tanks, pumps, meters, controls	8,900/well	17,800
Water injection wells		
Workover	7,000/well	14,000
Fittings, meter, etc.	2,000/well	4,000
Producing wells		
Large pumping unit, pump, tubing	25,000/well	50,000
Workovers (prorated)	5,000/well	10,000
Return water system	1,700/well	3,400
Sub-total		$123,200
Contingencies—10 per cent		12,300
Total investment per section		$135,500



This barge, the CUSS I, has been making exploration history by . . .

Drilling in Water Up to 1,500 Ft. Deep

● The C.U.S.S. Group has drilled from a floating barge off California at the rate of 450 ft. daily in high waves, strong currents. C.U.S.S. says drilling may be done cheaper and faster than similar work onshore.

LOS ANGELES.—A revolutionary technique for drilling offshore wells from a floating barge has passed its first year's apprenticeship in California's deep tideland waters.

Operators say that core-drill tests in waters up to 1,500 ft. deep have been a big success. Some tests have averaged 450 ft. per day in recent months, and the deepest hole drilled went to 6,300 ft.

The new procedure has been patented by the C.U.S.S. Group (Continental, Union, Shell, and Superior) and has been used by the group to drill more than 300,000 ft. of hole. Union Oil Co., operator for the group, reports it drilled with the same ease and at the same cost as similar footage onshore.

C.U.S.S. has now unlocked secrets held for 2 years on its drilling barge, CUSS I, and is claiming for the offshore drilling technique four features of "tremendous significance:"

. . . **It consists** of a conventional heavy drilling rig rigged up in a seagoing package, highly mobile and allowing immediate drilling with no rig-up time.

. . . **Within the present limits** of offshore exploration, there are no water depths yet found that are too great for drilling by the new method.

. . . **It offers huge savings** in comparison with past offshore drilling practices because there is no expensive platform construction and removal costs.

. . . **Conventional** blowout prevention and testing procedures are used.

Vital statistics . . . The CUSS I is a 260-ft., 1,479-ton converted YFNB, which serves as a floating platform for the seagoing rig. Total cost of the equipped barge is believed to be about $4 million.

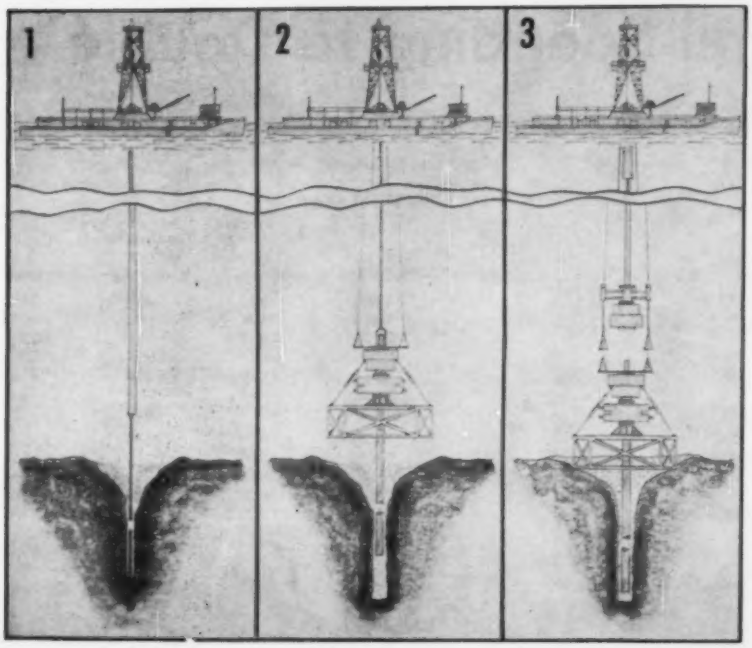
The barge is equipped to drill to depths of 10,000 ft. and deeper with 4½-in. drill pipe. Basically, its equipment consists of a National 80B draw works, two 700-hp. pumps, a 95-ft. derrick with a 500,000-lb. load capacity, and a central power package of four 600-hp. Cummins diesel engines.

The vessel draws 5 ft., 10 in. empty and 10 ft., 5 in. loaded.

In operation, it is towed to the drill site and anchored with six 7,500-lb. anchors secured with 1½-in. chains.

How it works . . . When the new-style barge anchors at the drill site, a typical drilling operation goes like this (see diagrams):

. . . **The drill pipe** and bit are lowered to the ocean floor through a well in the center of the barge. The pipe string which extends from the vessel



How it's done: (1) First step in ocean-floor drilling is to lower flexible drill pipe and bit through the barge well to the bottom. A surface hole is jet-drilled through sand and silt to a compact formation. (2) The hexagonal base, surface casing, casing head, and blowout preventers are lowered as a unit by guide cables. Note the guide cones on the casing head. (3) The surface casing is cemented. The packoff assembly is lowered down the guide cables and seats itself on the protruding mandrel. Guide cones fit snugly over those on the casing head to flange up the operation. The whole drilling operation is completed without the use of a diver.

is sufficiently flexible to permit lateral motion of the boat. Casing hangs below the barge for some distance to guide the drill pipe.

... **The surface hole** is jet-drilled to a competent formation below the sand and silt of the ocean bottom.

... **Next, two guide cables** lower the surface casing to the ocean floor. Attached are the casing head and two blowout preventers. The drill pipe guides the surface casing into the hole.

... **The surface casing** then is cemented and the packoff assembly lowered down the guide cables, which are attached to the blowout-preventer assembly.

... **The packoff assembly,** hydraulicly operated, seats itself on the mandrel, which protrudes up from the casing-head assembly. Guide cones, located on both the casing head and the packoff assembly, make certain the two units are set in place properly. The entire operation is performed without the use of a diver.

... **The guide cables** remain in place to guide drill pipe in making trips during drilling operations.

A unique feature of the technique is a permanent ocean-floored hexagonal base which serves as a support and guard for the blowout preventers, packoff assembly, and mud-circulating system connections.

On the barge itself, drill pipe is pulled and racked without a derrick man. The pipe, pulled in doubles, is transferred by the elevators and a chain hoist to a carriage which shuttles along the pipe walkway. The walkway carriage spots the double between two traveling conveyors in which drill pipe is stored. As each slot in a conveyor is filled, an empty slot rotates into place.

Owners enthusiastic . . . The owners of the CUSS I are pleased with the drilling experiment.

"The new technique enables drilling operations to be carried on in water far deeper than ever thought possible even a year ago," Robert Bauer, manager of C.U.S.S. operations, said in releasing information on the vessel's activities.

Bauer claimed the unitized drilling barge, when operating in or near navigable waters, probably can accomplish an exploratory drilling job cheaper and faster than a conventional exploratory job onshore.

"Moving time from one exploratory hole to the next is less than a day," he says.

C.U.S.S. made no reference to possible use of the technique in Gulf of Mexico offshore drilling, but Bauer pointed out that in recent months crews on the CUSS I have operated in high waves and strong ocean currents while drilling an average of 450 ft. per day in water up to 1,500 ft. deep.

The C.U.S.S. Group began working on the new technique in 1953 when the four companies banded together to carry on joint offshore exploration of California's tidelands. The ocean floor drilling control system was first tried out in early 1954. Basic processes are covered by patents granted or pending.

Prices Adjusted

Wyoming, Arkansas crudes cut by 8 to 10 cents barrel

REDUCTIONS in crude-price postings popped up last week in two widely separated oil-producing areas —Wyoming and Arkansas.

The cuts apparently represented local adjustments. They were not met immediately by other purchasers and did not spread outside specific areas.

Ohio Oil Co. posted an 8-cent per barrel reduction in prices for Wyoming heavy oils of 26° gravity and below. Prices for lighter Wyoming crudes remained unchanged. The effect was to move the price of 26°-gravity Wyoming crude from $2.44 to $2.36 a barrel, with a 5-cent per barrel downward scale for lower gravities.

Ohio gave this explanation: Since last December these heavy black crudes have been increased more than the 25-cent general-price increase. The new posting essentially restores their previous relationship to other crudes.

Indiana Oil Purchasing Co. of Tulsa, the buying agency for Standard Oil Co. (Ind.), adjusted prices 10 cents a barrel downward for most pools in Arkansas where it buys. Exceptions were Cairo, Falcon, and New London fields, where the reduction was 15 cents a barrel, and Catesville, where 20 cents a barrel was cut off the price. Only small volumes of oil are involved in these latter pools.

The cut makes prices for Village crude start at $3.05 a barrel for 40° gravity and above, most other fields $3 a barrel, and Falcon and New London $2.95 a barrel.

A large part of these crudes move to the El Dorado refining center where the lower prices make them more competitive with crudes from other areas.

10-Year Capital Spending to Double

- **Chase Manhattan says free world capital outlay to total $130 billion.**
- **Expansion means big chunk of money will come from outside sources.**

THE WORLD'S oil industry is going to have to dig deep for $130 billion over the next 10 years if it expects to keep pace with the rising use of oil products.

The industry won't find that much in its own till, either.

Those are two of a great many predictions which stand out in the latest annual survey of oil-industry capital expenditures made by Chase Manhattan Bank of New York. The bank's petroleum economist, Fred G. Coqueron, has been making the studies for years.

This time he goes several steps further. He makes a year-by-year capital-expenditure estimate for the major divisions of the industry for the next 10 years. His figures get bigger each year.

The 10-year prediction of the amounts the industry will have to spend ties in pretty close with the supply-demand estimates made in the bank's recently published "Future Growth of the World Petroleum Industry."

1956 set new record . . . The bank's study reveals that last year's spending for replacement and expansion of property, plants, and equipment fits a now familiar pattern.

The oil industry spent 19 per cent more last year than it did in 1955. The total is a healthy $9,800,000,000 for the free world. This compares with $8,245,000,000 in 1955.

Last year's capital expenditures were up only 8 per cent for the United States industry, but the free foreign world jumped 42 per cent. Included in this big foreign increase was $310 million paid for new oil concessions in Venezuela. There will be another $375 million to boost the 1957 figure, too.

The last 10 years . . . To support his predictions for the 1957-1966 period, Coqueron can marshal the figures for the last 10-year period.

During that time the world's industry invested more than $63 billion in the United States and other free countries. The U. S. industry accounted for the lion's share with more than $42 billion.

Coqueron expects this pattern to continue, but with foreign investments taking an increasing share of the capital.

Most of the money spent in the past went into oil-production activities. This will continue. The production figures, both in the past and in the future, include dry-hole costs, but not geological and geophysical expenses and lease rentals.

During the last 10 years, 59 cents of the oil industry's invested dollar was aimed at finding and producing more oil. The bank predicts that an almost identical part of the future invested dollar will go for the same purpose.

Refineries and chemical plants accounted for slightly more than 16 per cent of the money invested from 1946 until this year. The bank believes this will rise slightly between now and 1966, but it will still be just under 17 per cent.

The next 10 years . . . Coqueron bases his estimates of future capital expenditures on 1957 dollar costs. He expects new and intensified exploration in new areas, expansion of the Middle East pipeline systems, new major pipelines in Europe, and new refineries and chemical plants in new areas of the world to keep the expenditures on the rise.

In the next 5 years, according to the study, it will be necessary for the industry to invest another $55,700,000,000. Of that total $35,300,000,000 will be spent in the U. S.

It will take that much money to

Estimated Free World Capital Expenditures, 1957-1966

(Figures in millions of dollars)

UNITED STATES

	Production	Refineries and chemical plants	Transportation and marketing	Combined
1957	4,600	875	850	6,325
1958	4,850	900	900	6,650
1959	5,100	1,000	950	7,050
1960	5,400	1,025	1,000	7,425
1961	5,675	1,050	1,100	7,825
1957-61	25,625	4,850	4,800	35,275
1962	5,900	1,150	1,175	8,225
1963	6,125	1,200	1,250	8,575
1964	6,400	1,275	1,325	9,000
1965	6,625	1,325	1,450	9,400
1966	6,900	1,375	1,500	9,775
1962-66	31,950	6,325	6,700	44,975
1957-66	57,575	11,175	11,500	80,250

FREE FOREIGN

1957	*1,600	750	1,550	3,900
1958	1,300	775	1,625	3,700
1959	1,425	850	1,700	3,975
1960	1,550	900	1,800	4,250
1961	1,700	1,000	1,900	4,600
1957-61	7,575	4,275	8,575	20,425
1962	1,825	1,100	2,025	4,950
1963	2,050	1,200	2,150	5,400
1964	2,225	1,300	2,300	5,825
1965	2,450	1,400	2,450	6,300
1966	2,725	1,500	2,625	6,850
1962-66	11,275	6,500	11,550	29,325
1957-66	18,850	10,775	20,125	49,750

TOTAL

1962-66	43,225	12,825	18,250	74,300
1957-66	76,425	21,950	31,625	130,000

*Includes $375 million for concessions in Venezuela.

Estimated Free World Capital Expenditures and Investment, 1956

(Figures in millions of dollars)

	Free world	United States	Free foreign	Canada	Venezuela	Other W. Hemisphere	Western Europe	Africa	Middle East	Far East	Unallocated
Capital expenditures:											
Production	6,025	4,475	1,550	400	*680	140	35	70	135	90	0
Pipelines	325	175	150	40	35	10	5	0	50	10	0
Marine (including tankers)	675	50	625	5	5	0	0	0	0	0	615
Refineries and chemical plants	1,550	825	725	80	70	145	275	5	50	100	0
Marketing	1,050	450	600	120	10	70	235	45	15	105	0
Others	175	75	100	10	0	5	15	0	50	10	10
Total	9,800	6,050	3,750	655	800	370	565	120	300	315	625
Gross investment, December 31:											
Production	34,250	26,000	8,250	1,600	3,275	1,085	375	175	1,050	690	0
Pipelines	4,700	3,175	1,525	375	240	120	60	5	660	65	0
Marine (including tankers)	6,900	1,000	5,900	30	35	0	0	0	0	0	5,835
Refineries and chemical plants	13,900	7,850	6,050	625	550	1,075	2,275	75	675	775	0
Marketing	9,400	4,700	4,700	500	90	700	1,975	350	235	850	0
Others	1,725	975	750	70	10	20	165	20	380	20	65
Total	70,875	43,700	27,175	3,200	4,200	3,000	4,850	625	3,000	2,400	5,900

*Includes $310 million for concessions.

supply the more than 21 million barrels of oil needed daily by the world's consumers, the bank says.

In the following 5 years, the industry will have to spend another $74,300,000,000, and $45 billion of it will be spent in the U. S. This will be needed, the bank says, to furnish the more than 28-million barrels of oil daily which the world will need by 1966.

That's a total of $130 billion in 10 years, $80,300,000,000 of it to be spent in the U. S. and another $49,700,000,000 in other free foreign countries.

Where's it coming from? . . . The oil industry, probably more than any other, has financed its expansion through its own capital in the form of retained earnings and capital-extinguishment charges. It will keep right on doing that, but it will need other money, too.

Coqueron cites the U. S. figures for 1956 and finds that the domestic oil industry needed $850 million from outside sources to meet its capital requirements.

Last year the U. S. oil industry netted $6,500,000,000.

It paid out $1,300,000,000 in dividends to its owners, leaving $5,200,000,000 in the till. Capital expenditures were $6,050,000,000 leaving the deficit which required outside financing.

In the next 5 years, the industry should net $39,900,000,000 and pay out $8,000,000,000 in dividends. This leaves $31,900,000,000 which is almost $3,400,000,000 short of the anticipated capital expenditures.

New stock sales . . . Two of the world's largest oil companies have announced plans to raise funds through sale of stock.

Cash Income, Disposition

(U. S. Petroleum Industry)

(Figures in millions of dollars)

	Retained cash income	Capital expenditures	Funds from other sources
1952	3,629	4,400	771
1953	4,119	5,025	906
1954	4,268	5,350	1,082
1955	4,726	5,600	874
1956	5,200	6,050	850
Total	21,942	26,425	4,483
1957	5,700	6,325	625
1958	6,000	6,650	650
1959	6,400	7,050	650
1960	6,700	7,425	725
1961	7,100	7,825	725
Total	31,900	35,275	3,375

Standard Oil Co. (N.J.) is issuing new stock for the first time in 30 years. The company plans to raise $250 million to $300 million from the sale. This is the second largest common-stock offering in the history of U. S. financing.

The Royal Dutch-Shell Group will go Jersey Standard one better in a planned financing program for next year. Shell may raise as much as $400 million in new capital.

The two parent companies of the world-wide oil group disclosed their plans just 2 days after Jersey Standard's announcement. The Royal Dutch-Shell stock offering will be made early in 1958.

Royal Dutch Petroleum Co., The Hague, owns 60 per cent of the group of companies which operate all over the world. Shell Transport & Trading Co., London, owns the other 40 per cent. Stock of both companies is traded on the New York Stock Exchange.

It has been estimated that 25 per cent of Royal Dutch is in American stockholder's hands. There is no estimate on U. S. ownership of Shell Transport.

The money raised will be used "for future capital expenditure." The stock offering will raise an estimated $323 million to $417 million, and could dwarf the largest sale of stock to stockholders by any American industrial concern. The General Motors offering of $328 million in February was the previous top.

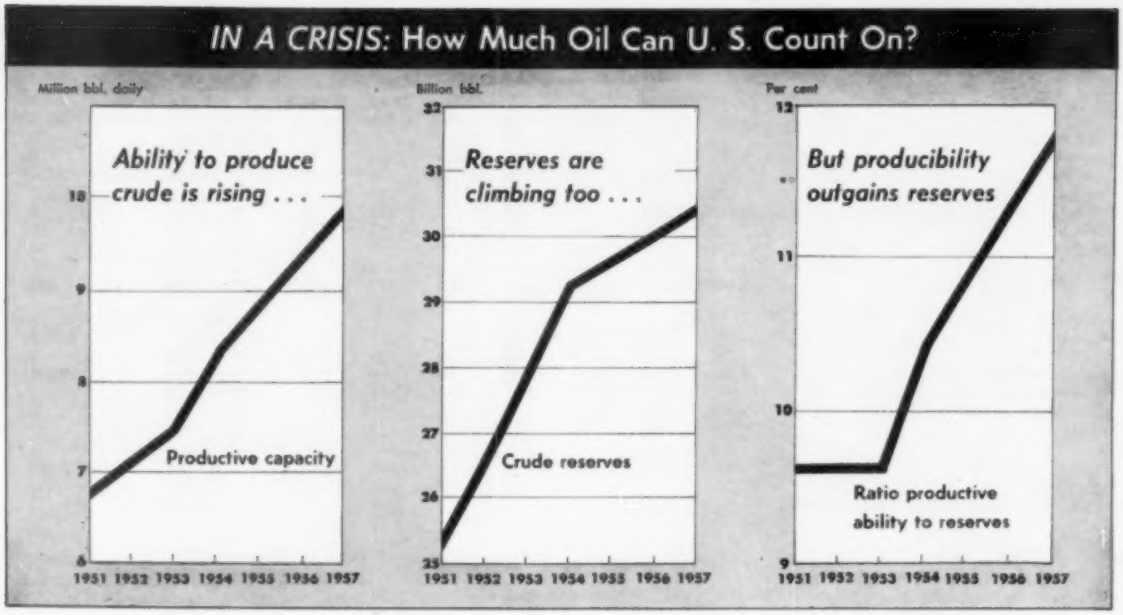
A variety of reasons were given for the step taken by Jersey Standard, including high cost of money, unwillingness to increase funded debt, and inability to meet capital needs through earnings. Jersey plans to spend $1,250,000,000 on capital needs and exploration this year.

Shamrock Expanding System

AMARILLO, Tex.—Shamrock Oil & Gas Corp. is under way on a major expansion of its products-pipeline system in the Texas Panhandle.

The company, through the affiliated Emerald Pipe Line Corp., has started buying right-of-way for a 120-mile, 6-in. line from its 25,000-bbl. Sunray plant to Tucumcari, N. M. A terminal will be built at Tucumcari. Capacity of the line, with one station at Sunray, will be 6,000 to 7,000 bbl. per day.

Shamrock is also converting a 120-mile, 6-in. crude line from Sunray to near Liberal, Kans. This line will be converted to products as far as Turpin, in the Oklahoma Panhandle, where a terminal will be built to serve Oklahoma and western Kansas. Initial capacity of the line will be 10,000 bbl. per day. This line may be extended into Kansas, depending on market development.



Latest study gives this picture:

- PRODUCTIVE CAPACITY has reached 9,867,000 bbl. daily of crude. This is up 1,536,000 bbl. daily since 1954.
- WITH NO NEW DRILLING this capacity to produce would drop 750,000 bbl. daily or 7.5 per cent the first year.
- WELLS NEEDED to maintain productive capacity: 41,000 to 50,000 a year.
- RESERVES have climbed too: From 25.2 billion barrels in 1951 to 30.4 billion in 1957.
- BUT TECHNOLOGY has permitted oil to increase ability to produce faster than to add reserves. All of this means . . .

Steel Is Key to Oil's Emergency Role

PARTIAL ANSWERS came last week to the big defense question: What can the nation expect from the oil industry if an emergency arises?

The information is contained in a terse, fact-filled report of the Committee on Petroleum Productive Capacity of the National Petroleum Council. The report was filed with the NPC last week.

This committee is headed by L. F. McCollum, president of Continental Oil Co. It went to work at the request of the Interior Department's Office of Oil and Gas.

Boiled down, the report says:

. . . **The nation's crude reserves** are the greatest in history.

. . . **The oil industry's ability** to produce oil also has reached a new peak.

. . . **But in order to keep up** this pace during a crisis, officials must see to it that the vital flow of steel is kept moving to the oil industry to sustain drilling and maintenance operations.

Capacity . . . The industry's capacity to produce crude was put at 9,867,000 bbl. daily at the first of this year.

An additional 845,000 bbl. daily of natural-gas liquids could be produced. Together with crude they make a total petroleum productive capacity of 10,712,000 bbl. daily.

The committee pointed out, however, that transportation facilities may reduce this capacity. The group recalled experiences during the recent Suez crisis. Then transportation facilities in a number of fields, particularly Texas, were not adequate to handle full productive capacity.

As a result, it emphasized this bit of caution: "It must not be assumed that all of the oil producible in the United States can be made available to markets on short notice."

The study also showed that the nation's productive capacity has enjoyed a steady increase since 1951. Productive capacity in 1951 was 6,727,000 bbl. daily. It rose to 8,331,000 bbl. daily in 1954 and increased another

1,536,000 bbl. daily by the first of 1957.

In the past 30 months, productive capacity for all petroleum liquids has increased at the annual rate of 646,000 bbl. daily. In the 18 months between January 1953 and July 1954, the annual rate of gain was only 625,000 bbl. daily.

New drilling . . . This productive ability, however, cannot be sustained for more than a brief time without drilling.

Committeemen declared depletion of reserves by production brings about a normal decline in productive capacity. This will vary from field to field. Some fields with water drive and pressure-maintenance facilities could sustain present productive capacity for a considerable period. Others would show a nearly immediate decline in productive capacity.

In case of a prolonged emergency sufficiently grave to restrict drilling, projects for additional water injection or other means of increasing productive capacity could be undertaken. These would offset part of the decline sure to be experienced in other fields during the emergency.

The committee estimated that without new drilling the productive capacity of the nation would decline 735,000 bbl. daily during the first year of an emergency. That's a drop of 7.5 per cent.

To keep capacity from dropping at all, the industry must keep on drilling from 41,000 to 50,000 wells a year. This wide range was given because of two different experiences. Under recently favorable development conditions, oil men believe they could sustain productive capacity with 41,000 wells a year. But during World War II it took 22,500 wells a year to sustain production of 4,300,000 bbl. daily. This would indicate a need for 50,000 wells a year to sustain the present volume.

Story on reserves . . . The nation's reserve supplies of oil have increased along with the industry's ability to produce.

They have risen from 25,268,000,000 bbl. in 1951 to 30,435,000,000 bbl. in 1957.

When productive capacity is compared to reserves some interesting figures emerge. In 1951, the industry could produce 9.7 per cent of its reserves. This ability had increased to 11.8 per cent in 1957. Economists say this merely means the industry is more efficient in producing oil than it is in finding oil.

This productive ability also may have been enhanced by several major technological developments in the last few years. These include:

. . . Multiple completions. Prior to this development, production from one stratum was deferred until the other had been depleted. An increasing number of wells have been completed in recent years to produce from multiple zones at the same time.

. . . Hydraulic fracturing. This treatment of producing formations in new wells frequently increases the productive capacity to a greater degree than it increases the economically recoverable reserves. Also successful fracturing has led to drilling many new wells near old marginal producing areas. This has made oil rapidly available that might otherwise never be produced.

. . . Water floods and pressure maintenance. These and other means of stimulating or maintaining production rates often add more to productive capacity than to reserves.

How Productive Capacity Tops Reserves

Dist.		Estimated reserves* (million bbl.)	Productive capacity: Estimated† (thousand bbl. daily)	Productive capacity: Per cent of reserves
	January 1951			
1.	East Coast	204	54	9.8
2.	Mid-Continent	2,926	1,083	13.5
3.	Southwest	17,091	4,161	8.9
4.	Rocky Mountain	1,313	350	9.7
5.	West Coast	3,734	1,079	10.6
	United States	25,268	6,727	9.7
	January 1953			
1.	East Coast	212	49	8.5
2.	Mid-Continent	3,392	1,238	13.3
3.	Southwest	18,934	4,686	9.0
4.	Rocky Mountain	1,569	394	9.2
5.	West Coast	3,854	1,098	10.4
	United States	27,961	7,465	9.7
	July 1954			
1.	East Coast	191	43	8.2
2.	Mid-Continent	3,851	1,380	13.1
3.	Southwest	19,414	5,224	9.8
4.	Rocky Mountain	1,893	561	10.8
5.	West Coast	3,904	1,123	10.5
	United States	29,253	8,331	10.4
	January 1957			
1.	East Coast	226	37	6.0
2.	Mid-Continent	4,300	1,591	13.5
3.	Southwest	20,017	6,613	12.1
4.	Rocky Mountain	2,120	615	10.6
5.	West Coast	3,772	1,011	9.8
	United States	30,435	9,867	11.8

*American Petroleum Institute figures as of the beginning of 1951, 1953, and 1957, and the average at the beginning and end of 1954.
†National Petroleum Council reports.

Where U. S. Has Its Productive Capacity

(Thousands of barrels daily)

Crude oil— District:	Jan. 1951	Jan. 1953	July 1954	Jan. 1957	Annual rate of change: 1951-53	1953-54	1954-57
1. East Coast	54	49	43	37	—2	—4	—2
2. Mid-Continent	1,083	1,238	1,380	1,591	78	95	85
3. Southwest	4,161	4,686	5,224	6,613	262	359	555
4. Rocky Mountain	350	394	561	615	22	111	21
5. West Coast	1,079	1,098	1,123	1,011	9	16	—45
Total crude oil	6,727	7,465	8,331	9,867	369	577	614
Natural-gas liquids	573	694	765	845	61	48	32
Total	7,300	8,159	9,096	10,712	430	625	646

It is this improved technology and more intensive development of proved reserves that now enables the domestic oil industry to produce at a higher rate than during World War II. This should prove of value in an emergency, but the committee warned:

"This fact does not permit any relaxation of the industry's efforts to find and develop enough new reserves to enable the industry both to keep pace with the steady growth in peacetime demand for petroleum and to maintain sufficient reserve capacity for any sudden emergency."

Role of steel . . . The committee made a special point of advising that the oil industry should be assured adequate supplies of steel during an emergency.

Lack of steel would curtail or halt drilling, result in loss of trained drilling crews, and hamper other emergency activities, including:

. . . Maintenance work on existing wells.

. . . Increasing capacity by installing additional power and pumping equipment, flow lines, and other transportation and storage facilities.

. . . Expanding production through new water-injection or other projects.

The report points up this fact: The oil industry moves on steel and is crippled without it.

Other reports . . . The council also received reports from studies made by two other committees on:

. . . Available L.P.G. This was put at 8,482 million gallons in 1956 and could increase by as much as 817 million gallons this year. The committee, headed by W. K. Warren, board chairman of Warren Petroleum Corp., declared that in an emergency production would be increased to 15,383 million gallons a year through plant expansions. Maximum availability from present plant facilities could be as much as 12,800 million gallons under emergency operations.

. . . Aboveground storage. The capacity is 415 million barrels of crude, 560 million barrels of clean products, and 97 million barrels of residual fuel. This report was made by a committee headed by Robert L. Milligan, president of Pure Oil Co.

Storage capacity for clean products increased about 19 per cent in the last 3 years. Capacity for crude and residuals both declined 2 per cent in the same period.

Milligan's committee reported the industry still finds it necessary to maintain 2 bbl. of storage for each barrel of inventory. This is a change from last March when the ratio was 2.2:1.

watching WASHINGTON

. . . with Bertram F. Linz

Death of free trade? . . .

THERE'S a big reason, aside from the welfare of the domestic producers, for the Government to bend every effort to make its oil-import program a success.

The Reciprocal Trade Act expires next year. The President will ask that it be continued. But the future of the administration's foreign-trade policy may well hinge on the outcome of the oil program.

Oil-state senators let it be known even before Congress quit last August that if imports aren't under control next year they will tack a quota clause onto the trade act extension bill.

A quota was kept out of the law in 1955 only by Eisenhower's acceptance of the national security clause. But if a new drive is started there will be no room for compromise.

Talk of a quota for oil will bring support from the coal interests. Other industries hurting from imports also will get on the band wagon. The big charge will be that the administration has shown it can't protect even most vital industries from being smothered by foreign producers.

In the past, Eisenhower has fought quotas bitterly. He isn't likely to change his stand next year. The result could be a stalemate in Congress and death of a foreign-trade policy which has been building for 20 years.

Wanted: Bids on shale project . . .

ANOTHER fight may be shaping up over Government vs. private shale-oil development.

The Navy, which owns the shale reserves and claims the processing plant at Rifle, Colo., has plans to lease both to private industry. Interior Sec. Fred A. Seaton says he has no objection. But there is considerable opposition to the idea in Congress.

Two bills now are awaiting action at the Capitol. A Senate measure favors setting up a new research program for the Bureau of Mines. A House bill backs the idea of turning it over to private enterprise.

The Bureau of Mines started a research program at Rifle in 1944. The plant was closed in 1955 when Congress refused to provide any more money for the work. Since then, Congress twice has refused funds.

The Navy is expected shortly to call for bids on a lease. If it could make a contract in the next 3 months it might head off action on the plan for new government research.

Some congressmen from the Rocky Mountains don't want the Rifle plant to fall into the hands of industry. And Seaton points out that his department still runs the laboratory research and says it will continue.

Agencies all shook up . . .

THE administration's economy drive is paining some of the federal oil agencies. Although the agencies were given bigger funds by Congress for this fiscal year, they are finding it hard to pry the added money out of the budget bureau.

It's all part of a plan to keep 1958 spending at the 1957 level, as ordered by the President. One effect of the order, as the industry already knows, will be to cut military oil buying by well over $115 million (see related story on page 95).

Usually, at the start of the fiscal year the budget bureau tells the agencies what they can spend in each of the four quarters. But this year it is parceling money out only for one quarter at a time.

As a result, some oil studies are shaky because the bureaus don't know whether they will be able to run them as planned months ago. Bureau chiefs say they could arrange matters if they only knew what they would have for the year. It's the uncertainty that's getting them down.

CB&I Reactor-Stripper Starts Japan Journey

CB&I reactor and stripper being removed for loading on SS President Harrison of American President Lines. Reactor is 13 feet 8 inches in diameter, stripper is 6 feet 8 inches in diameter.

This 50-ft. long reactor and its traveling companion, a 37-ft. stripper are part of a shipment of CB&I-fabricated structures furnished for a Japanese oil refinery. The vessels were furnished through the Universal Oil Products Company for Idemitsu Kosan Ltd., Tokuyama, Japan.

OUTWARD BOUND . . . for points all over the world, is the rule rather than the exception with CB&I. Global representation and a *world of experience* in design, fabrication and erection stand behind every CB&I-built petroleum storage or processing structure. For further details write our nearest office.

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Liquid-Gas Test Set Up

Britain begins preparing special tanker and storage for experiment; first shipment may be made within 18 months

THE FIRST SHIPMENT of liquefied natural gas will move by special tanker from Venezuela to Great Britain within the next 18 months.

The movement will inaugurate a practical study of the economics involved in supplying liquefied gas to Britain for industrial and domestic use. If the idea proves practical, it will open a huge market for gas not only in Britain but also in other areas remote from pipelines.

Announcement of the plan was made in London by Sir Harold Smith, chairman of the British Gas Council. He revealed some details of the project in addressing industrial writers.

What's involved . . . Two chief facilities being prepared for the test are:

. . . A 3,500-ton tanker. It is being especially insulated to withstand the low temperature of minus 250° F. needed to keep the methane in liquid form.

. . . Refrigerated storage in England. This storage is now being erected to receive the liquefied gas and then process it to supplement Britain's conventional sources of town gas: Coal, coke-oven gas, and oil gas.

Should the trials prove a success and the British Government approve entry of liquefied natural gas on a large scale, experts make these estimates:

. . . Three 30,000-ton tankers of special design making 15 journeys each year could move sufficient gas to supply half of Britain's present needs.

. . . Risks involved do not exceed those attending movement of crude across the Atlantic by tankers.

. . . Impact on British economy could be great. Large-scale imports of methane would provide communities and plants with a much cheaper fuel than they now can obtain.

Competitive costs . . . American researchers studying the problem report a tanker load of liquid methane delivered in Great Britain could be sold as a gas at 80 cents per M.c.f. compared with $1 to $2 per M.c.f. for manufactured gas (OGJ, June 10, p. 66).

Raw-material costs are an important factor in making the liquefied gas competitive. The 80-cent price was based on 4-5-cent Venezuelan gas. But even higher-priced Gulf Coast gas still will be competitive up to 20 cents per M.c.f., the Americans said.

British Government and industrial officials have been interested in the liquefied-gas process for more than 3 years. The Gas Council first sent a technical mission to Chicago in mid-1954 to study the method proposed by W. L. Morrison. Morrison proposed to liquefy Gulf Coast natural gas and barge it up the Mississippi River to Chicago. In converting the liquid back to a gas he expected to obtain refrigeration for the Chicago stockyards and then planned to sell the gas as fuel (OGJ, Mar. 22, 1954, p. 104).

A few months later the British minister of fuel and power reported to the House of Commons the project would succeed in Britain only if gas could be brought in and supplied to the British consumer at substantially lower prices than gas produced from coal.

The International Bank, reporting on progress of the Morrison plan, declared in 1955 that technical obstacles to moving liquid gas by sea were being overcome. It estimated such a project would save Britain millions of tons of coal a year.

Then last year engineers of the North Thames Gas Board outlined the form a typical liquefied natural-gas supply project would take. Their plan apparently is the one to be followed in the initial tests.

The British engineers suggested introduction of liquid methane must come gradually, starting on the basis of a small ship with the possibility of stepping the movement up to base-load operation. The gas will have to be moved in small shipments until a sufficient degree of reliability of supply can be established.

British engineers estimated equipment needed to supply the equivalent of 200,000 M.c.f. a day of gas with 500 B.t.u. per cubic foot to London from Venezuela would require:

. . . Four tankers each capable of carrying 15,000 tons of liquid natural gas.

. . . Storage tanks of about 25,000 tons capacity at both the sending and receiving ports.

. . . Gas pretreatment and liquefaction plants rated at 110,000 M.c.f. of natural gas per day.

Their estimates of capital investment required totaled about $112 million. This compares reasonably with investment needed for gas-production and purification plants of conventional design in England. The engineers thus concluded — just as Americans did—that the economic attraction of liquefied natural gas would rest primarily with the cost of gas at its source.

Chrysler to Use Fuel Injection

DETROIT.—Wider use of fuel injection is coming in 1958.

Chrysler Corp. has revealed that it will use the electronic model developed by Bendix Aviation Corp. in some high-performance models of Plymouth, Dodge, De Soto, and Chrysler cars next year.

The Bendix unit differs from others in use in departing from the mechanical metering of fuel to the cylinders. Precise fuel requirements are determined by a small electronic "brain" from such variables as throttle position, air temperature, engine load, altitude, and engine temperature. An electric impulse then opens the fuel intake for exactly the correct interval to permit injection of the proper amount of gasoline.

Cost of fuel injection on the Chrysler cars will be announced when the models are introduced later this month. It will be offered as optional on the V-8 Plymouth Golden Commando, the Dodge models using the D-500 V-8 engine, the De Soto Adventurer, and the Chrysler 300-D. The last two will be sports cars.

This year Chevrolet offered General Motors' version of fuel injection, but very few passenger cars were sold with this equipment. American Motors this year offered a version of the Bendix system on its Rambler Rebel at a price of $395.

Fuel injection is expected to bring greater fuel economy, increased power, faster engine warmup, and will avoid carburetor icing on cool, damp mornings. Its ultimate effect on fuel specifications is still being debated. Early in its development some research work indicated that it would permit use of a wider boiling range gasoline. If this does prove to be the case, refiners will have to wait until all carbureted engines are off the road before they can look for any such changes. In view of the very gradual introduction of fuel injection, that day appears to be far off.

. . . the home stretch

Ahead of Schedule

Westcoast Transmission Company's 30-inch natural gas pipeline was completed about two months ahead of schedule.

The 800-mile system extends from Peace River gas fields to the International Border and to cities in British Columbia, across some of North America's most rugged terrain.

Bechtel had a major part in this development—so important in Canada's flourishing economy—having been manager of engineering and construction of the project and constructor of part of it.

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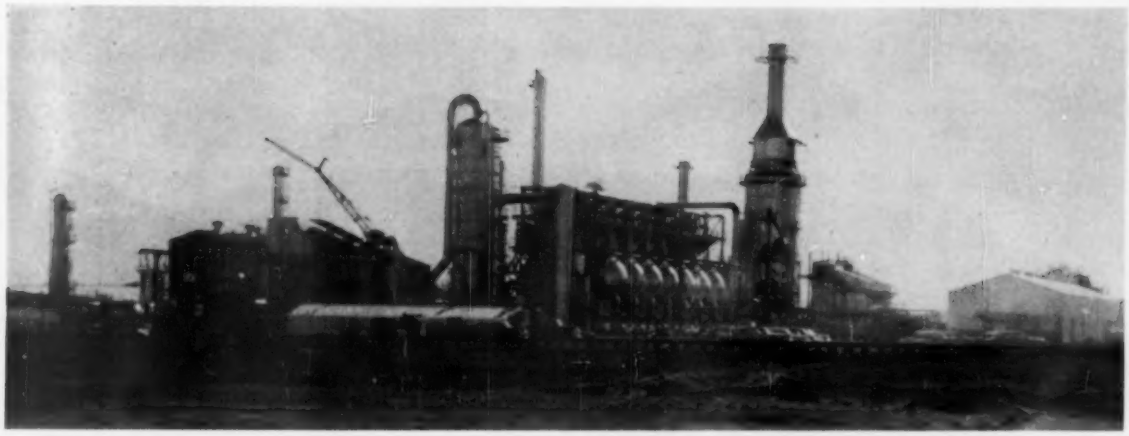
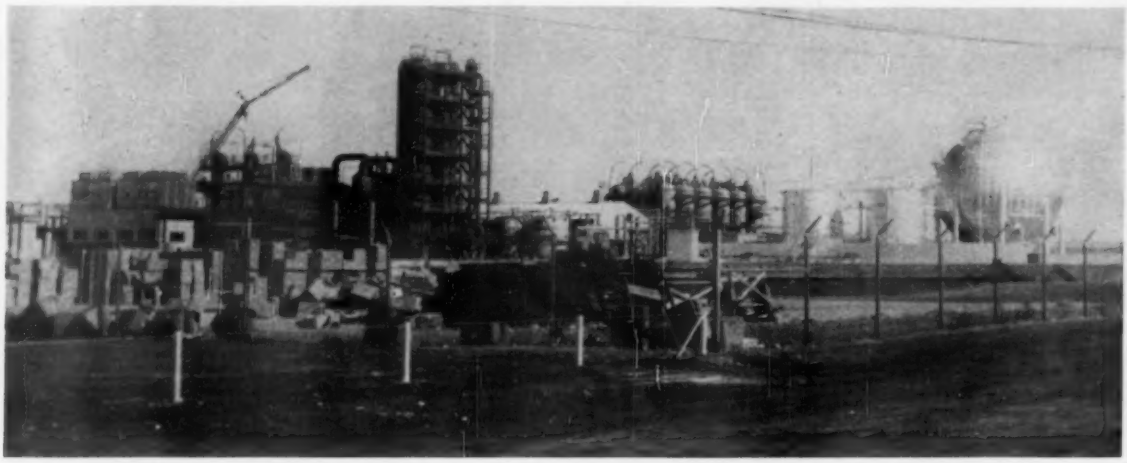


Odessa Butadiene's new plant has started turning out raw material for . . .



General Tire's nearby copolymer plant now gearing to make synthetic rubber.

West Texas Complex Goes on Stream

ODESSA, Tex.—One of the world's most remarkable petrochemical operations spewed out its first synthetic rubber early last week.

Some time this week, the giant complex is expected to shift into high gear and begin turning out rubber at near capacity of 40,000 long tons per year.

The complex sprang out of the barren West Texas prairie at the southeast edge of this community in only 15 months. It is a pioneering venture mainly of General Tire & Rubber Co. and El Paso Natural Gas Co. United Carbon Co. and Odessa Natural Gasoline Co. are smaller-scale participants.

The Odessa operation will be fully developed next spring with completion of a styrene plant. Then it will represent an investment of $37 million. But a new El Paso Natural refinery nearby designed to operate partially on byproducts from the chemical plants will swell the outlay further.

The complex establishes several "firsts" in petrochemicals. It is remarkable because it:

. . . **Has a single production flow** in converting natural gas to rubber.

. . . **Is located far inland.** The plant site is right on top of the raw-material sources. Conventional practice is to locate such plants near the coast to take advantage of cheap water transportation.

. . . **Boasts first use of private capital** in building a copolymer plant.

. . . **Junks conventional layout** for GR-S plants. A new streamlined design cuts labor and maintenance expense.

Integrated operation . . . The petrochem operation, though producing rubber from gas in a single, continuous flow, will involve five different plants operated by five different companies.

Raw materials reach the central site via a 40-mile, 6-in. products line from El Paso Natural's Midkiff natural-gasoline plant in Spraberry Trend field.

The line funnels butane into Odessa Butadiene Co.'s just completed 50,000-ton butadiene plant. Odessa Butadiene is owned by El Paso Natural Gas Products Co., an El Paso Natural Gas Co. subsidiary, United Carbon, and Odessa Natural. El Paso holds controlling interest.

El Paso officials told the Journal last week that the $20-million butadiene facility has been turning out product meeting specifications in test runs for the past 2 weeks. It will supply 32,000 tons of butadiene a

year to the neighboring General Tire & Rubber Co. copolymer plant.

General Tire has been taking product for system fillup. And Odessa Butadiene also has been filling and shipping tank cars "to other markets."

Styrene raw material for the rubber-making process currently is brought in from the Gulf Coast. This will continue until Odessa Styrene Co., a firm owned 75 per cent by El Paso Natural and 25 per cent by United Carbon, completes its $5-million styrene unit at the complex about the first of the year.

Propane raw material for styrene manufacture then will start flowing through the products line from the Midkiff plant along with the butane.

The $12,000,000 General Tire GR-S plant is fed butadiene by pipeline from the Odessa Butadiene facility. The rubber plant operates directly off this line, thus butadiene intake is held to that amount necessary to make the desired amount of rubber.

Design innovations . . . General Tire thinks its new plant design will save it more than enough in labor and maintenance to offset added product transportation costs due to its location away from tidewater.

The most radical departure in the plant's design is that it abandons the lengthwise or lateral arrangement of units in favor of a new radial layout. This permits General Tire to go to a central control system rather than the three or so control points required in the older GR-S plants. It cuts labor costs sharply and simplifies maintenance.

The plant also boasts a dual process-system. Materials handled in rubber making are notorious for plugging plant lines. The dual lines will permit the plant to keep going when a line is plugged merely by switching to the spare. The savings from avoiding plant shutdowns due to line plugging are expected to be substantial, too.

Construction continues . . . While Odessa Butadiene and General Tire flange up their plans for official plant opening ceremonies, slated for October 18 and October 17-19, respectively, construction work is being pushed at the other plant sites.

Process-unit foundations have been poured for both the styrene plant and El Paso Natural Gas Products' new 6,000-bbl. refinery.

The refinery, set for completion late in February shortly after the styrene unit starts up, will take high-octane raw materials — butylene, isobutane, and propylene—from the butadiene and styrene plants to make high-octane gasoline.

Processing briefs

Irving Oil Co., which is planning a major refinery at St. John, N. B., may be negotiating with Standard Oil Co. of California for crude sources. An announcement is expected soon.

California Standard says it is not in a position now to comment on reports it will share in the project. The company operates on Canada's Pacific Coast through Standard Oil Co. of British Columbia, Ltd., but is not active in eastern Canada.

Polyethylene capacity will get a major boost with two new plants just announced.

Union Carbide Co. will build a 72-million-pound high-pressure plant at Whiting, Ind., using ethylene from Standard Oil Co. (Ind.) refinery. This will give Carbide a total capacity of 375 million pounds per year, half of the national total. Du Pont is completing plans for a new plant near La Place, La., to make linear polyethylene. It has properties similar to the high-density product from low-pressure type of process. No capacity has been announced.

National Petro-Chemicals Corp. also announced last week the location of a 75-million-pound polyethylene plant. It will be built on the Houston Ship Channel in the area set aside by Phillips Petroleum Co. for industrial development. The plant, announced several weeks ago, will be completed in late 1958.

Gulf Oil Corp. has completed two 20,000-bbl. per day Gulfining units at its Philadelphia refinery. The two hydrogen-treating units are expected to exceed their design capacity for processing heating oil, if they perform as well as the two original Gulfiners of the same size placed on stream several months ago at Gulf's Port Arthur plant.

One Port Arthur unit is Gulfining 25,000 bbl. daily of light catalytic gas oil, while the other is charging 27,000 bbl. daily of virgin distillate. Both are operating at lower temperature than anticipated. This will extend catalyst life and reduce frequency of regeneration. M. W. Kellogg Co. built all four Gulfiners.

Atlantic Refining Co. is on stream with two 15,000-bbl. Unifining-Catforming units. One is operating at the company's 156,000-bbl. Philadelphia refinery and the other at its 65,000-bbl. Port Arthur, Tex., refinery. Process design for the units was developed by Atlantic. Engineering and construction was hand.ed by Blaw-Knox Co.

Atlantic is also building a 21,000-bbl. alkylation unit at Port Arthur to increase output of high-octane motor fuel. Fluor Corp. is the contractor. Completion is expected next spring.

A second Ultraforming unit has been completed at the Whiting refinery of Standard Oil Co. (Ind.). A third unit is being built. The new 21,000-bbl. cat reformer has been in continuous operation since its initial startup August 19. Steel work is now being raised for a twin unit. The original Ultraformer at Whiting is rated at 14,000 bbl. per day.

Three other processing units were recently put on stream at Whiting: a 60,000-bbl. crude unit that increased refinery capacity to about 220,000 bbl. and permitted retirement of several small crude units; a 6,000-bbl. lubricating plant which replaced older, obsolete facilities; and alkylation capacity for aviation and motor-fuel blending stocks.

Phillips Petroleum Co. expects to complete a Penex unit at its Borger, Tex., refinery early next year. The new unit will catalytically convert normal pentane to isopentane. The process was designed and developed by Universal Oil Products Co., Inc. The unit will produce 13,500 bbl. of isopentane daily.

Also for Refiners . . .

IN THE NEWS: Military purchases of petroleum products will decline after 1959 by 1 per cent annually (p. 95) . . . Prices are adjusted downward for Wyoming and Arkansas crudes (p. 101) . . . Chrysler will introduce fuel injection in 1958 models (p. 108) . . . Vast Odessa petrochemical complex is partially on stream (p. 110) . . . Carson rejects requests by importers for quota hikes (p. 118) . . . Texaco's new Cuba refinery is on stream (p. 121).

PLUS THESE TECHNICAL REPORTS: How to spot and remove refinery bottlenecks, a 16-page section (p. 123) . . . Nelson's refinery construction index (p. 143) . . . Making ethylene oxide by direct oxidation (p. 150) . . . COST-imating (p. 169) . . . PETROdatics (p. 171) . . . Field processing (p. 172) . . . and Refiner's Notebook (p. 177).

With air tanks to keep it from bending:

C.A.T.C. Line Gets Final Link

NEW ORLEANS. — The deepest offshore pipeline, buried under as much as 100 ft. of water, was scheduled to be completed by last weekend.

The 25-mile underwater system, built by Marine Gathering Co. for the C.A.T.C. Group, consists of 6, 8, and 12-in. lines connecting three production platforms to a terminal on Grand Isle, Louisiana.

Designed for two-phase flow of liquids and gas, the system will handle production from Blocks 40 and 47, Grand Isle area. The 12-in. main line has a capacity of about 31,000 bbl. of liquids and 46,000 M.c.f. of gas per day.

The flow will be separated and measured at the onshore terminal. From there, gas will go into a transmission system and crude will go to either a pipeline or barges.

Additional gathering lines are planned by the C.A.T.C. Group as production is developed from other platforms in the area. The group includes Continental Oil Co. as operator, Atlantic Refining Co., Tidewater Oil Co., and Cities Service Production Co.

To prevent unnecessary stress on the pipe as it was lowered to the gulf bottom, air tanks were attached to the line as it left the barge (see photo).

Pipeline Buys Pembina Gas

CALGARY.—Alberta & Southern Transmission Co., Ltd., which plans a $330-million gas pipeline from Alberta to the San Francisco area, has completed contracts for a reported 80 per cent of gas available in Pembina field.

President J. K. Horton says the company has signed 27-year contracts with 51 Pembina producers and is negotiating in other fields.

Horton didn't mention prices or the amount of gas involved, but last month his pipeline signed up 200,000 M.c.f. with Shell Oil Co. (OGJ, Sept. 2, p. 92). This is nearly half the 1,300-mile line's projected capacity of 450,000 M.c.f. daily.

Most producers in Pembina are members of the Pembina Operators' Committee which has been negotiating for sale of processed gas to Northwest Utilities, Ltd., a partner in Alberta & Southern, until the California line is completed in 1960.

Products removed . . . The gas would go first to a 95,000 M.c.f. field-processing system planned by Goliad, Ltd., Canadian subsidiary of Harry Bass & Sons, Inc., of Dallas (OGJ, Aug. 19, p. 98).

The system would remove 120,000 gal. of propane, 76,200 gal. of butane, and 52,560 gal. of pentane-plus daily. Plans call for nine refrigeration separation plants, a central fractionating plant, and a 47-mile gathering system.

Horton's announcement said Alberta & Southern is scheduled to start purchasing in October 1958, about the time the processing system is scheduled to go on stream. At that time gas would go to Northwestern Utilities through a 75-mile, 16-in. line to Edmonton. This line, together with gathering facilities, is yet to be built.

Northwestern and a sister company, Canadian Western Natural Gas of Calgary, have first call on supplies through the California line before consideration of export. Canadian Western is also a partner in Alberta & Southern. The two companies went into the deal after Pacific Gas & Electric Co. of San Francisco had formed the export pipeline company.

Kenai Well Finaled

Choked back to 360 bbl. after 900-bbl. daily flow

ANCHORAGE.—Richfield Oil Corp. completed its wildcat on the Kenai Peninsula of Alaska flowing 900 bbl. of 33°-gravity oil and 122,000 cu. ft. of gas daily through a 1½-in. choke.

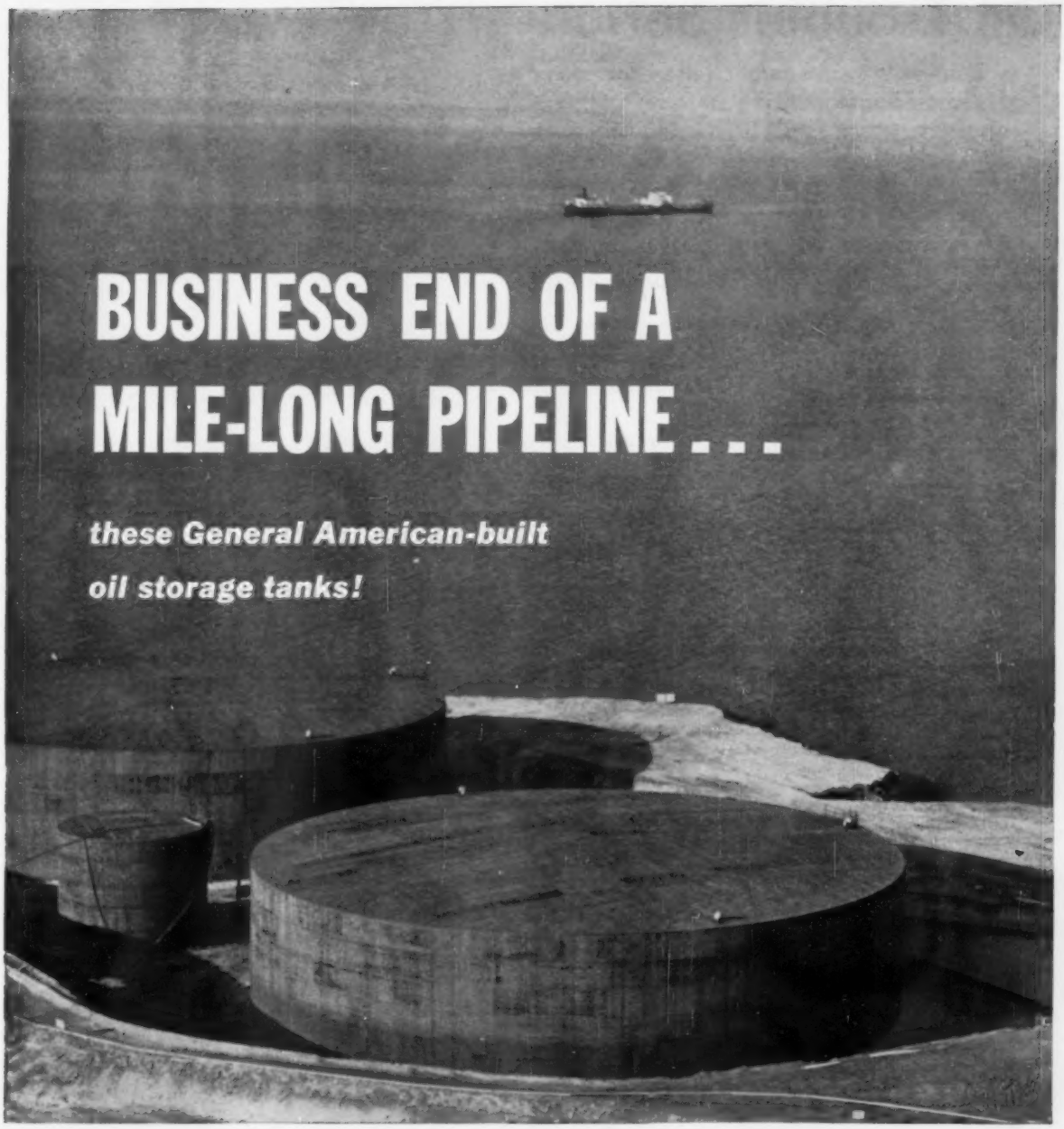
The well, 1 Swanson River Unit, was then choked back and was last reported making 360 bbl. of oil, 0.2 per cent cut, and 50,000 cu. ft. of gas daily through a 9/64-in. choke. Tubing pressure was 900 psi.

The 1 Swanson River Unit is producing from perforations at 11,150-11,215 ft. It was drilled to a total depth of 12,384 ft. and 5½-in. casing was set to 12,000 ft. Location is about 40 miles southwest of Anchorage.

Richfield holds an 89½ per cent interest in 71,600 acres of federal land around the discovery. Union Oil Co. of California and Ohio Oil Co. hold the remaining interest equally. Richfield is operator for the three-company combine (OGJ, July 29, p. 107).

Richfield has staked location for another wildcat about 2 miles south of the discovery well, the first of any consequence in Alaska. No date has been set for spudding in the offset.

In another Alaskan development to the southwest, Humble Oil & Refining Co. and Shell Oil Co. have started drilling their first wildcat in the Kanatak area on the Alaskan Peninsula. The Humble-Shell Bear Creek 1, projected to 12,000 ft., is about 350 miles southwest of Anchorage and inland from Jute Bay. Humble is the operator.



Moored more than a mile offshore in 70 feet of water, even the world's largest tankers (or any tanker presently contemplated) can deliver cargoes direct to these twin 268,000-barrel storage tanks . . . eliminate double handling and costly barging charges.

Each 200 feet in diameter, 48 feet in height, the tanks were custom-engineered, erected on the site by General American's Plate and Welding Division for Northville Dock's new Long Island Terminal. New York State's largest tanks . . . they provide storage for 22,500,000 gallons of oil.

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Oil Troubles Serious

● Robertson warns public ready for controls, Thompson says consolidate thinking or else; both agree that oil's in-fighting has to stop or the industry faces slow death

FORT WORTH. — Warring segments of the U.S. oil and gas industry were warned twice here last week that their fussing, if continued, could spell slow death for the entire industry.

The warnings came from Gen. E. O. Thompson, Texas Railroad commissioner, and French M. Robertson, outgoing president of the Texas Mid-Continent Oil and Gas Association. They were delivered during the thirty-eighth meeting of the Texas Mid-Continent Oil and Gas Association October 1.

Robertson rebuked independents and majors alike for fighting among themselves, primarily over imports.

No phrase, he said, is too strong to describe the seriousness of the Texas producer's position under today's market condition. "We cannot pooh-pooh his fears about the future. But we have yet to see how dissension in our ranks can promote the sale of one barrel of oil."

Independents, he continued, seeing much of their market drifting away, have bitterly and publicly attacked major firms importing oil. The majors, in turn, have dealt damaging blows to domestic producers "by telling the people we are running out of oil in order to justify a position on imports."

By so doing, Robertson said, both are running a great risk of creating a climate wherein the general public could go for iron-clad federal control of the industry at the urging of those who want the Government "to referee every oil deal and fix every price."

Division breeds ills . . . Thompson, too, feels that industry scuffling is proving ruinous.

"Never," he said, "in the history of modern petroleum affairs has it been so important to the industry and to our country and the free world that oil men of all classifications understandingly work for common goal."

"Most of the troubles you have in Congress and in the state legislature (Texas) come from division in thinking and lack of planning within the industry as a whole. How does the public know what to think when one side says one thing and the other side has a contrary view? When one listens to the conflicting opinions on imports, is there any wonder that the people in general are confused? If you cannot agree on what is good for America, your cause is ill-fated."

There should be sound public-relations planning with all elements of the industry represented, Thompson said, before anything is presented to the public. There never has been two opinions alike, he said, "but you should get your thinking done and consolidated before you fight in public."

Harris bill . . . Charlton Lyons of Shreveport, president of the Mid-Continent Oil and Gas Association, told the group that the industry's last chance to get favorable natural-gas legislation will come next year.

Never again, he declared, will there be support of a bill from all three segments of the gas industry, from the Federal Power Commission, and from the administration. Nor is there any chance, he said, that a complete decontrol bill will be passed in the next 5 or 10 years.

It is the Harris-O'Hara bill or nothing, Lyons said, and it is a good bill because it gives 90 per cent decontrol and producers have room to move around in the 10 per cent of their business left under control. If the bill fails, he warned, the industry "will be in a hell of a fix" because the defeat would open the door to a whole flood of other legislation against the oil and gas business.

Robertson, left, bows out to Alcorn as . . .

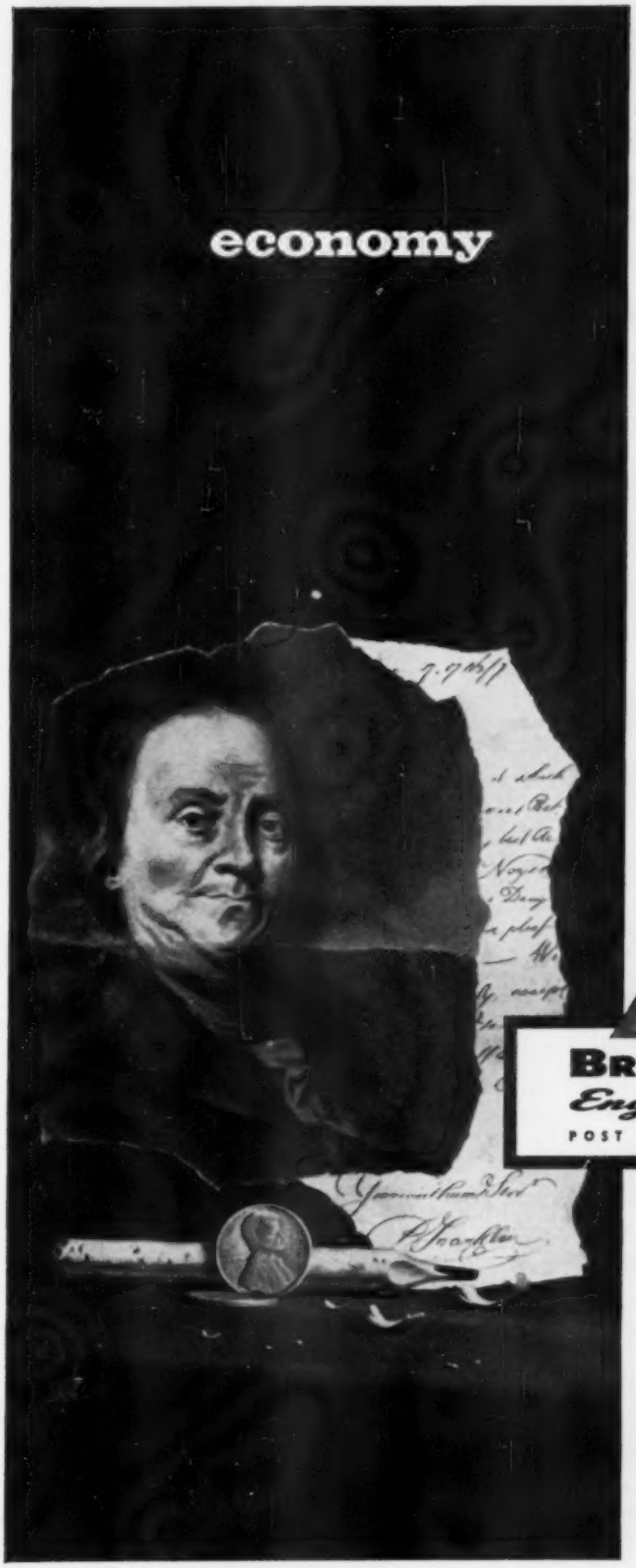
Texas Mid-Continent Elects

FORT WORTH.—Charles W. Alcorn, Houston, executive vice president of Falcon Seaboard Drilling Co., last week was elected president of the Texas Mid-Continent Oil and Gas Association. Alcorn is the association's sixteenth president.

Alcorn, an independent oil producer and drilling contractor who began his oil career 38 years ago, succeeds French M. Robertson, Abilene independent operator.

The Houston oil man started in oil in 1918 as a roustabout for Tex-La-Homa Oil Co. in Louisiana, became a farm boss, and resigned in 1920 to join his cousin in Oklahoma as a wildcatter and lease trader. The partnership drilled a dry hole and a gas well (about the same as a dry hole in those days) before Alcorn gave it up to become a roustabout for Shell Oil Co. in Osage County, Oklahoma.

By 1924, Alcorn had worked up to superintendent of Shell's North and Central Texas district. In 1927, he was promoted again to assistant general superintendent of the company's central division in Dallas. He left Shell the same year to become an independent producer at Wichita Falls, Tex., and subsequently built up oil production in Archer and Young counties. He later sold these holdings and in 1935 joined Theodore N. Law of Tulsa to form Falcon Seaboard Drilling.



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Leasing Is Banned

Government tightens up game-refuge lease policy

WASHINGTON.—The Interior Department has hung a "Keep Out" sign on federal wildlife refuges to ward off oil hunters.

New regulations will ban all oil and gas leasing except to prevent drainage of government oil by private operators on adjacent lands.

There will be two exceptions to the rule: Limited leasing will be permitted on big-game ranges, mostly in Alaska, and on state-federal cooperative units where drilling can be carried out without danger to the range or wildlife.

The no-leasing move is a tightening up of Interior's previous policy of allowing leasing of some refuges. But last year this policy came under fire in Congress.

How it started . . . Leasing of refuges was permitted under the Mineral Leasing Act of 1920. But wildlife conservationists have always opposed it. Relatively few leases were granted up to 1953. At that time leasing was suspended while the rules were tightening up.

In December 1955, new regulations were issued, and a 13,140-acre lease was granted to Frankfort Oil Co. in the Lacassine Waterfowl Refuge in Cameron Parish, Louisiana.

But conservationists immediately attacked the lease, carrying their fight to Congress where a House committee looked into the matter. Former Sec. Douglas McKay agreed to advise the committee of any further leases. Nearly 300 applications then pending were shelved.

Esso Cuts Crude Purchases

BATON ROUGE, La.—One big crude-oil buyer will cut purchases in two states another 5 per cent in October, while another company has announced plans to increase purchases in all states.

Esso Standard Oil Co. (N.J.) says that "critical oversupply" means Esso will take only 95 per cent of its September purchases in Louisiana and Mississippi. The cutback is expected to total about 8,000 bbl. a day.

Esso had previously reduced purchases by 15 per cent August 1. Since then, the company says processing at its big 340,000-bbl. Baton Rouge refinery has been reduced further.

Magnolia Petroleum Co. will increase crude purchases in all states during October and will end proration completely in Texas and Louisiana.

The new move is a result of lower allowables in both Texas and Louisiana, an increase in refinery demands, and sale of crude to other purchasers.

However, proration will continue in Oklahoma, New Mexico, and Illinois at the August rate, which was lower than last month. September proration in these states was 90 per cent of August.

Deep Well Offset

Richardson & Bass seeking third producer on lease

NEW ORLEANS.—Richardson & Bass has spudded a second offset to the world's deepest well in Plaquemines Parish, Louisiana.

The new well, the 2-K Louisiana Land & Exploration Co., is projected to 18,000 ft., considerably shallower than the record holder. Associated with Richardson & Bass in the venture are John W. Mecom and Freeport Sulphur Co.

Location is about 1,300 ft. west of the record-depth well, the Richardson & Bass 1-L Humble L.L.&E., which was drilled to 22,570 ft. It also is on the opposite flank from the first deep offset, Richardson & Bass 1 Humble-Price State Lease 2345 (OGJ, Sept. 23, p. 71).

The recently completed offset, which flowed oil at the rate of 861 bbl. daily, has been assigned a daily allowable of 343 bbl. by the state conservation department. A Richardson & Bass official indicated a higher allowable will be sought after a market is established for the oil. Production in the first offset is coming from a zone at 19,151-74 ft. The record holder is now producing about 235 bbl. of oil per day from below 20,700 ft.

Sunshine Signs Crude Pact

TACOMA, Wash.—Sunshine Mining Co. has contracted to sell production from 1 Medina, Washington's first commercial oil well, to U. S. Oil & Refining Co. of Tacoma.

The 1 Medina's potential was set at about 220 bbl. daily in Sunshine's latest report. The well will be put on production as soon as U. S. Oil & Refining empties storage tanks.

In a last-minute change of plans, Sunshine spudded in 2 Medina, northwest of the discovery, last week. The company previously announced it would drill 1 Beach as its first offset (OGJ, Sept. 30, p. 57).

Texas Offers Leases

School-land lease sale includes 30,000 acres

AUSTIN.—Oil and gas leases on 30,000 acres of land in 12 West Texas counties will go on the auction block here October 22.

The leases are on University of Texas lands and are being offered by the Board for Lease of University of Texas Lands. They will go to the bidder of the highest bonus at the customary one-eighth royalty and $1 an acre annual rental.

The lands up for lease are in Crane, Upton, Reagan, Crockett, Irion, Schleicher, Terrell, Pecos, Ward, Loving, Andrews, and Martin counties. They include five drilling blocks calling for specified minimum bonuses and the drilling of wells within 6 months.

Tract 59 includes six parcels of land totaling 1,945 acres in Reagan County. Minimum bonus asked is $15,000. And a well must be drilled in 6 months to 3,300 ft.

Tract 86 takes in eight parcels totaling 2,734 acres in Crockett and Irion counties and calls for a $25,000 bonus and an 8,500-ft. test.

Tract 93, with 1,280 acres in Crockett, requires a $10,000 minimum bonus and a 2,200-ft. well.

Tract 107, with 2,639 acres in Pecos County, requires a $30,000 bonus and 6,500-ft. test.

Tract 128, with 2,560 acres also in Pecos, calls for a $25,000 bonus and 5,500-ft. test.

FPC Approves Gas Storage

PITTSBURGH. — Equitable Gas Co. plans to add underground storage for another 1,100,000 M.c.f. of natural gas in West Virginia this year. The Federal Power Commission has authorized gas storage in three formations of the depleted Rhodes gas pool in Lewis County.

Equitable already has 13 underground storage facilities in Pennsylvania and West Virginia with total capacity of 32,327,000 M.c.f. But the firm says normal growth in demand during the next 5 years will require additional storage capacity of about 10,475,000 M.c.f.

The company plans to inject 1,100,000 M.c.f. into one of the zones this year and develop the other two formations after the first is completed. The project will cost $2,091,000 and will include drilling of 40 wells, construction of a dehydration plant, and laying about 12 miles of pipeline.

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Quota Hikes Rejected

Importers given evidence administration determined to make controls work; slash of West Coast shipments asked

WASHINGTON. — Oil importers testing the voluntary control program found new evidence last week of the administration's determination to make it work.

Three of the first appeals for higher quotas heard by Capt. M. V. Carson, Jr., last month were turned down as "unwarranted."

And any attempt to step up imports of residual fuel and refined products to get around the limits on crude will result in extension of the program to those items, Carson warned.

The companies whose appeals were rejected are Standard Oil Co. (Ind.), Tidewater Oil Co., and Standard Oil Co. (Ohio).

Indiana Standard had asked for an increase of 23,700 bbl. daily to its quota of 29,800 bbl. daily. Tidewater asked that its 34,200-bbl. quota be upped by 27,800 bbl. Ohio Standard, with a quota of 8,200 bbl., asked for an additional 5,300 bbl.

Officials of Indiana Standard announced quickly that company would comply with the decision and follow the program. Government officials hoped others also would go a'ong.

The Indiana Standard and Tidewater cases were the toughest test of the program, involving much larger increases than asked by any other company. Of the two, Tidewater was considered the most important.

It asked for a higher quota on the ground that its $200,000,000 investment in a new Delaware refinery is threatened because of its inability to import crude during the 1954-56 test period after its Bayonne plant was closed and before the new one went on stream.

Some praise . . . Speaking for domestic producers, Robert L. Wood, president of the Independent Petroleum Association of America, praised the decisions.

He said they went far to promote confidence within the industry that the program will be carried out.

"Captain Carson is to be commended for the promptness of this action and the firmness in holding to the original program," Wood said. He expressed confidence that the companies will comply and support the program.

Still within limit . . . If all three companies yield to the Government's edict, the import level will be within inches of the 755,700-bbl. ceiling set by the cabinet committee by next January.

This was indicated in figures released by Carson last week from the second batch of reports and forecasts that are filed monthly by importers.

The reports showed that August imports averaged 966,800 bbl. daily. July imports were 846,000 bbl. a day.

The 5-month forecasts put January receipts at 806,900 bbl. daily. This would be some 51,000 bbl. higher than the program ceiling. But the figures included the increases which the three companies hoped to get.

The average for the 5 months ending with January would be somewhat higher than the imports for that month alone—809,400 bbl. But, again, this would include anticipated increases in quotas.

Carson said the reports show that "considerable progress" will be made in reducing imports through the remainder of this year. He emphasized, however, that the success of the program can be measured only by the continued cooperation given by importers.

"The degree of cooperation with the Government that already has been assured encourages me to look forward to its complete success," he added.

Residual and products . . . Carson's comment on residual and product imports stressed the warning by the cabinet committee in its July 29 report that a stepping up could be used as a means of foiling crude controls. The committee, he said, is keeping them under continuous study.

Carson said if the committee finds that product imports are being upped to get around the crude curbs "action will be taken to bring all such imports under a program similar to that for crude oil."

His statement was seen as reflecting the views of the committee, which took up the problem at a meeting late last month.

Observers saw the fate of the program hinging on two factors:

. . . The course of product imports.

. . . Tidewater's reaction to rejection of its plea.

A steady increase in product imports as an offset to lower crude receipts, as well as refusal of Tidewater to go along with the program in the face of a cut of 50,400 bbl. from its

How Imports Will Look Through January

(DISTRICTS I-IV, thousands of barrels daily)

	Allocation, year ending	— Actual —		Estimated					
Established importers	6/30/58	July	Aug.	Sept. est.	Oct. est.	Nov. est.	Dec. est.	Jan. est.	5 mo. av.
Atlantic	58.9	66.3	55.4	79.8	60.0	62.9	49.8	57.0	61.9
Gulf	111.6	153.5	142.9	105.0	104.0	104.0	104.0	104.0	104.2
Sinclair	62.2	64.5	85.8	54.6	72.4	73.3	79.6	72.2	70.4
Socony	67.1	73.7	76.9	79.0	70.4	70.4	70.4	70.4	72.1
Standard of Calif.*	66.8	70.7	101.4	92.6	54.1	47.5	47.7	59.3	60.2
Jersey Standard†	72.0	77.0	81.0	82.0	62.0	62.0	62.0	72.0	68.0
Texas	54.5	68.1	75.5	48.7	34.5	61.2	39.2	44.0	45.5
Subtotal	493.1	573.8	618.9	541.7	457.4	481.3	452.7	478.9	482.3
New importers									
Cities Service	32.6	30.0	47.0	33.0	34.0	31.0	32.0	28.0	31.6
Eastern States	18.3	12.4	24.0	40.9	22.3	18.9	18.8	27.0	25.6
Gabriel	7.5	...	...	...	...	11.3	11.3	11.3	6.8
Great Northern	33.0	27.9	28.0	29.0	33.0	33.0	33.0	33.0	32.2
International Refg.	10.9	10.9	13.4	9.0	6.0	13.0	13.0	13.0	10.8
Lakehead P. L.	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Lake Superior	5.0	4.2	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Northwestern	10.0	5.0	5.0	14.0	18.0	18.0	18.0	18.0	17.2
Phillips	12.0	16.3	...	19.0	11.9	13.9	10.9	12.0	13.5
Shell	7.5	...	...	...	...	5.0	5.0	5.0	3.0
Standard (Indiana)‡	29.8	26.9	53.6	36.9	40.6	35.5	40.0	40.0	38.6
Standard of Ohio‡	8.2	...	4.0	7.2	14.0	12.0	12.0	12.0	11.4
Sun	50.4	60.9	58.1	65.4	59.7	52.9	52.4	52.4	56.6
Tidewater‡	34.2	72.1	109.0	67.1	70.0	54.5	70.2	62.0	64.8
Southwestern†	2.9	2.6	...	...	3.6	3.8	3.6	...	2.2
Bay Petroleum	...	2.5	...	2.5	3.0	5.5	5.5	5.5	4.4
Dow Chemical	...	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3
Texas Asphalt & Refg.					3.5	3.5	3.5	3.5	2.8
Subtotal	262.6	272.2	347.9	329.5	325.2	317.4	334.8	328.0	327.1
Total	**755.7**	**845.0**	**966.8**	**871.2**	**782.6**	**798.7**	**787.5**	**806.9**	**809.4**

*Includes American Bitumuls. †From Texas Railroad Commission August Imports Report. ‡Includes proposed increases that were denied.

planned imports for its new refinery, could make necessary action by President Eisenhower to put controls on a mandatory basis, it was predicted.

Actual imports in July were 8,300 bbl. less than originally reported (OGJ, Sept. 23, p. 65). The August reports show that this was due to revision of figures for two companies.

Where companies stand . . . Total imports of the seven "historic" importers, while higher in August than in July, will get below the group quota this month for the first time and will continue at below-quota levels, the forecasts showed.

The quota for the group as a whole is 493,100 bbl. daily. The average for the September-January period now is estimated at 482,300 bbl. a day. However, three companies—Atlantic, Sinclair, and Socony — will still be above their quotas. Sinclair has a plea for a higher quota pending.

Ten of the 18 "new" imports will be down to quota or below for the period. The remaining eight include six companies which have asked for increases. Another, Sun Oil Co., declined to join the program although gradually reducing imports. The eighth, Phillips Petroleum, will be close to quota by the year-end.

West Coast wants in . . . Captain Carson, meanwhile, heard testimony last week that the West Coast oil industry is headed for trouble unless import restrictions are imposed there too.

That area is now exempt from voluntary limitations.

Stark Fox, executive vice president of the Oil Producers Agency of California, took issue with the cabinet committee's findings regarding the West Coast oil industry. The committee said that imports of 275,000 bbl. daily were proper to maintain the difference between demand and domestic crude supplies in District 5.

Fox made two strong points:

. . . Imports are not running at the 275,000-bbl. level. They averaged 316,000 bbl. daily in July and August and probably will average 299,000 bbl. daily for the last half.

. . . Products supplies, not crude supplies, should be considered in the imports plan because the West Coast traditionally refines crude instead of storing it. Fox said products stocks are now exceeding the 52 days' supply which is considered the desirable level.

Fox recommended that West Coast imports be cut to 187,000 bbl. daily in the fourth quarter and should be held to 194,000 bbl. daily for the first half of 1958.

Pipeline briefs

Continental Oil Co. has purchased 12½ per cent interest in Butte Pipe Line Co. from Placid Oil Co. of Shreveport. Purchase price was not revealed.

Butte operates a 16-in., 510-mile crude line from East Poplar field in northeastern Montana to Fort Laramie and Guernsey, Wyo. The line has a capacity of 49,000 bbl. daily, but an expansion program now under way will boost this to 65,000 bbl. by spring. Other owners are Shell Oil Co., the operator with 60 per cent interest, Murphy Corp., 17½ per cent, and Northern Pacific Railway Co., 10 per cent.

Pembina Pipe Line, Ltd., will complete 30 miles of 4 to 6-in. gathering lines next week. The project includes a gathing system for Rocky Mountain House field, and extends from Pembina to Williston Green field in Alberta. Mannix Co., Ltd., is the contractor. Mannix is also laying 35 miles of 3 to 6-in. crude gathering lines to connect new wells in Pembina and Keystone fields. This project should be finished by November 15.

Alberta Gas Trunk Line Co., Ltd., has completed the first phase of the gathering system which will supply gas to Trans-Canada Pipe Lines, Ltd. Fulton Banister, Ltd., laid 117 miles of 18 and 34-in. for the provincial company which ties in with Trans-Canada at the Alberta-Saskatchewan border near Burstall, Sask. Alberta Gas Trunk Line is connected to Provost and Bindloss fields, which will supply Trans-Canada the first year of its operation. An extension of the system is planned through 1960 to meet rising Trans-Canada demand as eastern Canada markets are opened and expanded.

Natural Gas Pipeline Co. of America has completed the first spread of its 350-mile, 20 and 26-in. main line from Bridgeport, Tex., north and westward through Oklahoma to Fritch in the Texas Panhandle. Eastern Pipeline Contractors, Dallas, laid 86 miles of 20-in. from Bridgeport to Healdton, Okla. H. B. Zachry Co. and River Construction Corp. are building the remainder of the line, which should be in the ground by November 15.

Magnolia Pipe Line Co. is nearing completion on one phase of its looping program and starting another. H. B. Zachry Co. will wind up this month on 23 miles of 20-in., 21 miles of 12-in., and 88 miles of 16-in. between Corsicana and Baird, Tex. O. R. Burden Construction Corp. has started rock ditch work on the western end of the project between Midland and Clyde, Tex. Pipe laying will begin soon. The project, to be completed around the end of the year, will increase capacity of Magnolia's West Texas-Gulf Coast crude system by 75,000 bbl. per day.

Transcontinental Gas Pipe Line Corp. has contracted part of its South Texas extension program to H. B. Zachry Co. Zachry is laying 22 miles of 14-in., 31 miles of 16-in., and 24 miles of 24-in. between Moore, Tex., and Transco's Ike West station. This is part of a 229-mile system which will tap shut-in gas in McMullen, Frio, and LaSalle counties. Zachry expects to complete its contract November 1.

Transco is paying 14.5 cents an M.f.c. for gas from deep Edwards fields in McMullen County and 13.5 cents in LaSalle and Frio counties. Producers include Frio-Tex Oil & Gas Co., Amerada Petroleum Corp., Texam Oil Corp., Standard Oil Co. (Tex), and Longhorn Drilling Corp. Gas will be fed into the main Transco line from Texas to New York near El Campo, Tex.

Cities Service Gas Co. will lay 80 miles of 30-in. along its main line between Independence and Welda, Kans., this fall. The job has been contracted to R. H. Fulton & Co. The project also includes taking up 150 miles of 16-in. pipe. Pipe laying is expected to get under way this month.

Also for Pipeliners . . .

IN THE NEWS: British will test moving liquefied natural gas by tanker from Venezuela (p. 108) . . . C.A.T.C. is completing its 25-mile underwater pipeline system in the gulf (p. 112) . . . Alberta & Southern Transmission has contracted for 80 per cent of the available gas in Pembina (p. 112).

PLUS THESE TECHNICAL REPORTS: How Natural Gas Pipeline modernized its system in a five-point program (p. 144) . . . and Pipeline Patrol's report on the engineering details behind the pipelining of gilsonite solids (p. 181).

U. S. Firms Ignore Sahara

● Only four American firms—Sinclair, Phillips, Newmont, and Cities Service—made bids for Algerian concessions

THE BAIT of Sahara Desert oil lands which the French dangled before the eyes of American major oil companies was still dangling last week. French officialdom was having a hard time concealing its disappointment. The big American companies expressed a general interest, but they did no bidding.

Three American independents, the Royal Dutch-Shell Group, and British Petroleum Co., along with myriad private French interests applied for Sahara acreage surrendered by two French government-controlled companies. The American majors, while expressing public interest, were conspicuously absent at the actual bidding.

Four factors may account for the lack of interest of the majors:

...A troubled political situation which is far from settled. The most recent French parliament crisis popped up last week when the current French premier, Maurice Bourges-Mannoury, submitted his resignation after a resounding parliamentary defeat on the Algerian question.

...An extremely short period of time in which to submit bids. The French announced abruptly August 10 that they would accept bids from interested companies for about 23,000 sq. miles of territory which the two French companies were compelled to give up at the end of their 5-year exploration terms. The bidding deadline was September 24.

...The requirement of at least 50 per cent French participation. This has been an issue which several American major companies have successfully avoided for a number of years. They show no disposition to give in now. The French are insisting that any company which applies for acreage in the French Sahara region have French partners.

Not many American major companies are willing to undergo a major exploration program under these conditions. They haven't had to do it yet anywhere else in the world. Apparently they are not willing to take on this kind of an encumbrance in face of the obvious odds involved in an oil search operation in the vastness of the Sahara Desert.

...A relative small amount of acreage available in comparison to the necessary expenditure.

The two French companies which originally held the concessions, Cie. Francaise de Petrole (Algerie) and Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), gave up half the acreage they held in only six licenses in Algeria. They had been expected to surrender 50 per cent of all 10 exploration concessions. This disappointed some of those interested.

Conorada Petroleum Co., the foreign exploration company owned jointly by three large American independents, Amerada Petroleum Corp., Continental Oil Co., and Ohio Oil Co., cited the acreage limitation as its reason for not making a bid at this time. Conorada says it may make a bid for Saharan acreage later when more territory is available.

Who did apply . . . Eight different groups did apply for the available acreage before the September 24 deadline (as extended from the original September 10 date). Three of them contain American capital represented by four American companies.

They are:

...Cities Service Co., with a 50 per cent interest in a combine which includes Ste. de Prospection et Exploitations Petrolieres en Alsace (P.R.E.P.A.) with a 30 per cent interest, and a new French company, Cie. Franco-Africaine de Recherches Petrolieres (Franco-Rep), with a 20 per cent interest.

...Sinclair Oil Co., with a 27 per cent interest, and Newmont Mining Co., with 18 per cent, in a combine which includes Ste. Francaise de Recherches de Petrole, a subsidiary of the government's Bureau de Recherchea de Petrole; Lazard Freres et Cie., a French banking house, and l'Omnium de Valeurs Agricoles Industriales et Minieres, a French mining investment company.

...Phillips Petroleum Co. in a combine which includes COPEFA, a subsidiary of the government's BRP and Omnium Francaise de Petroles (Omnirex), a French oil financing company in which the old Suez Canal company has an interest.

...Petrofina Francaise through Petroserap, a subsidiary of Petrofrance which is controlled by the Belgian Petrofina.

...C.R.E.P.S. (Cie. de Recherche et d'Exploitation de Petrole au Sahara), in which the Royal Dutch-Shell Group has a 35 per cent interest. C.R.E.P.S. is developing the shallow Edjele field in Algerian Sahara.

...Ste. Francaise des Petroles BP, the French affiliate of British Petroleum, in association with French interests that have not yet been firmed up.

...Pechelbron Ste. Anonyme d'Exploitation Minieres, an independent French oil company with other French interests.

...Cie. Francaise de Petrole (Algerie), one of the two companies which gave up the acreage, is applying for a portion of that surrendered by the other, SN Repal.

Conflicts . . . All these companies apparently have no difficulty in conforming to the French Government's requirements. It is almost certain, however, that most or all of them will ask for the same general area—just as near to the Hassi Messaoud discovery as they can get. This is certain to lead to application conflicts. Just how these will be settled by the French Government has not yet been explained.

It will be at least mid-October, probably weeks later, before any acreage awards are announced.

Gulf Drills Honduras Tests

BRITISH HONDURAS Gulf Oil Co. has started its second round of drilling in the crown colony of British Honduras.

The Gulf Oil subsidiary spudded its third well near Roaring Creek, about 50 miles east and to the south of Belize, the capital. A second rig will drill at Ower Hill, farther to the north. Kerr-McGee Oil Industries, Inc., is contractor for both wells.

Gulf moved a contract rig out of the country almost a year ago after drilling two dry holes. At that time the company said it wanted to review all data from the two wells.

Both the new tests are in the northern part of the little Central American country where the government last month extended Gulf's concession for another year. The company has until October 20 to choose 1,000 sq. miles of the southern sector. The remainder of the southern half will then be open for other companies (OGJ, Sept. 16, p. 117).

Texaco's new plant is now on stream as . . .

Cuba Adds Refining Capacity

A NEW 20,000-bbl. refinery built by The Texas Co. in Cuba is now on stream.

The plant is on a 400-acre site on the west side of the deepwater harbor about 3 miles south of Santiago de Cuba. Texaco has built a 1,000-ft. dock in water over 40 ft. deep. A dredging project is slated to open the entire harbor to tankers drawing as much as 40 ft. of water.

Construction of the $15-million refinery was started in November 1955 after the Cuban Government started a program to encourage foreign capital to invest in the country. It was built for The Texas Co. (West Indies), Ltd., by Procon, Inc. Work was under direction of the Texaco refining department.

Special processing units include a 3,300-bbl. Platformer and a 4,100-bbl. Texaco-designed hydrotreating unit. About half the refinery's output will be fuel oil, one-fourth kerosine and diesel oils, and the remainder gasoline.

The new refinery is connected directly to Santiago's water system, but Texaco drilled an additional six-well water supply which can supply 4 million gallons daily.

Charles N. Cutbirth, former superintendent of the Vengref refinery in Venezuela, is superintendent of the new refinery.

Capacity soaring . . . The new Texaco plant gives Cuba 53,700 bbl. daily of refining capacity. Two years ago it could boast of only three small refineries with about 10,000 bbl. daily process capacity.

The same government encouragement which lured Texaco, long a Cuban marketer, into Cuban refining also spurred two other major refinery projects.

Just a few months ago Cie. Petrolera Shell de Cuba put a new 25,000-bbl. refinery on stream at Havana, on the opposite end of the island from Texaco's plant.

Esso Standard Oil Co., S.A., has operated a 6,500-bbl. plant on Havana Bay for years. Before the end of this year Esso will complete an expansion program to boost this capacity to 35,000 bbl. daily.

The combined refining capacity for Cuba by early 1958 will be more than 82,000 bbl. daily, well in excess of its current domestic consumption of about 60,000 bbl. per day.

India Pipeline Surveyed

PIPE LINE ENGINEERING CO., Dallas, has started a survey of possible routes for Assam Oil Co.'s proposed 600-mile, 20-in. pipeline from Nahorkatiya field in Upper Assam to a refinery site at Barauni.

The Burmah Oil Co. subsidiary plans to add a 250-mile extension to Calcutta later. The line will have a capacity of 50,000 bbl. daily.

Collins Construction Co., Houston, marine pipeline specialists, currently has a crew in India studying crossings (OGJ, Sept. 9, p. 78).

Honduras Is Tested

● U. S. combine meets government stipulations, awaiting final approval

PETROLEOS HONDURANOS, S.A., a combine of seven U.S. independents, is awaiting official government certification of its 11,000,000-acre concession in Honduras.

The company has hiked its capitalization to $300,000 from the initial $100,000 before the September 26 deadline set by the government. This was the last act required of the company prior to certification.

The other major stipulation in the agreement was that the company spud its first well by last July 9. Petroleos Honduranos spudded in a 400-ft. strat test last June downdip from an oil seep in the Santa Barbara province area of the concession.

The strat test, plagued by a vexing fishing job, is just now nearing completion. Meanwhile, the company is carrying out extensive surface and aerial photographic reconnaissance.

A spokesman for the company said last week in Dallas that it expects to complete its exploratory work in about 6 months. It will know by then if there are structures worth drilling and, if so, where it will drill.

The combine . . . The seven independent partners are: Oil & Gas Property Management, Georesearch, Inc., McRae Oil & Gas Corp., American Maracaibo Co., Justiss-Mears Oil Co., Western Hemisphere Petroleum Corp., and D. Harold Byrd (OGJ, June 3, 1957, p. 82).

Petroleos Honduranos has opened an operating geological office at Tegucigalpa. The exploration program, however, is being planned and coordinated by Dr. Hans Swolfs from offices in New York.

The contract . . . The company's agreement with the Honduras Government provides for a 75-25 split of profits from any production found. The larger share goes to the company. The concession remains in force without rental payments as long as exploration continues.

By January 1, 1958, the company must pay $100,000 if it decides to keep the entire 11,000,000 acres. But it has an option to retain only 2,000,000 acres in three contiguous blocks without further payment.

It is likely the firm will go the option route since its preliminary reconnaissance indicates that only the smaller acreage in the concession is favorable for oil deposits.

Pemex Hits Deep Pay

New strike flows 3,528 bbl. of light crude daily, might hit 5,000 bbl. after further acid treatment, Pemex says

PETROLEOS MEXICANOS may be another big step closer to shoring up its skidding production.

The Mexican government oil agency claims it has a new deep discovery with a potential of more than 5,000 bbl. daily of 30°-gravity crude. The well is 1 Gran Morelos, about a dozen miles southeast of fast-growing San Andres field. The area is some 30 miles from the Gulf of Mexico in the State of Veracruz.

Pemex says the well is making 3,528 bbl. daily through 25/64-in. choke after the first acid treament. A second acid treatment, it says, should push this on up to the 5,000-bbl. mark or better.

Gran Morelos 1 was completed at 10,518 ft. in porous limestone of the Upper Jurassic. It reportedly had a flowing bottom-hole pressure of 6,653 psi. and static bottom-hole pressure of 6,745 psi. Tubing pressure during production was about 3,650 psi.

The deep play . . . The new discovery resulted from an intensive deep play which has turned up several other successes recently. Included on the list are 1 Hallazgo, between Gran Morelos and San Andres; Independencia, about 20 miles northwest of big Poza Rica field; and 1 Silozuchil, in the northern part of Veracruz about 7 miles from the town of Tantoyuca.

The 1 Silozuchil, according to Pemex, has added new interest to the area around old and fading Cerro Azul field, just to the east, without ever being completed. It blew out and was lost at 11,240 ft.

Before it was abandoned, however, it reportedly yielded more promising samples of light crude. Now Pemex is drilling an offset, which it is already calling a producer. The well, 2 Silozuchil, nearing 10,000 ft. at last report, will be completed soon.

Pemex's deep discoveries are timely. Mexico's older production is on the decline, shallow wells along the Golden Lane trend are petering out fast. In the first 8 months of this year, for example, crude and condensate outside San Andres field dropped from 245,508 bbl. daily to 209,753.

But San Andres, so far the most illustrious of the deep pays, was coming up fast during the same period—from 3,988 bbl. daily in January to 35,670 bbl. daily in September.

That means that the total, including San Andres production, actually fell only a little more than 4,000 bbl. daily—from 249,496 bbl. to 245,423. And Pemex says it is now expecting the country's daily production to climb to 300,000 bbl. or more by the end of 1958, largely through further development of San Andres.

Pemex says the relatively new field has not yet been defined and that successes in the area have been coming at the rate of more than one a month for the past year. San Andres now has 27 producing wells.

There are currently 14 rigs working in the area. Eight more are scheduled to go to work there soon so that 22 rigs will be operating through most of the next 12 months.

In addition to increased production, Pemex should get some help from the new deep discoveries in another way.

So far, Mexico hasn't been able to produce all the gasoline it needs. Its crude has been mostly heavy, but the new discoveries promise to help balance the supply with much-needed lighter crude, which should give Pemex a higher gasoline yield.

Oil Search in Paraguay

PURE OIL CO. will look for oil in Paraguay.

Reports from Asuncion last week indicate the government has granted the Chicago oil firm a "vast section" of the Chaco Boreal near the Bolivian border. Pure officials in Chicago concede they have been dickering for a concession but declined to comment.

The agreement for the oil search is being negotiated by Henry Holland, former U. S. Secretary for Foreign Affairs, according to the reports from Paraguay.

Paraguay has no oil production.

Superior Has Last Laugh as Wildcats Hit at Maracaibo

SINCE THERE has been an oil industry worthy of the name, the wildcatter has been the pillar of the business.

He has been willing to bet his time, money, and skill he could find oil where no one else could. He has kept the world from running out of oil.

Superior Oil Co. of California last week entered this class of superwildcatter with its uncanny luck in Venezuela. Here's the story coming up from Venezuela:

When Superior moved into the bidding for new oil concessions in Lake Maracaibo and paid the Venezuelan Government the top price of $2,831 an acre for a relatively small (7,774 acres) block of national-reserve acreage, oldtimers in Venezuela snickered.

As far as the wiseacres were concerned, Superior had spent a lot of money for worthless, underwater ram pasture. The best the company could possibly find was salt water.

Then Superior moved into the lake area and started building a $3-million pier and terminal on the west side of the lake near San Francisco. This turned those snickers to laughs of amazement. When the company moved not one but two rigs into the lake for a full-scale exploration effort on the tract, the laughs were almost guffaws.

Then Superior hit. The first well came in for 3,300 bbl. daily. It wasn't long until the second well tested more than 7,500 bbl. daily. This chilled a little of the amusement and caused some large-scale alibis around the Caracas offices of the Venezuelan veterans.

Even this was tempered by the insistence that everyone knew a large fault slices the Superior acreage and a "just-wait-'til-they-move-west-of-that-fault" attitude. The grins were all set to spread again when Lama 7, Superior's first well west of the fault, found only a thin pay in Miocene. Last week the well could boast of 304 ft. of a deeper pay.

As one Caracas wag puts it, the nicest thing the established companies did for the newcomers was to keep their maps under wraps.

Bottleneck Removal...

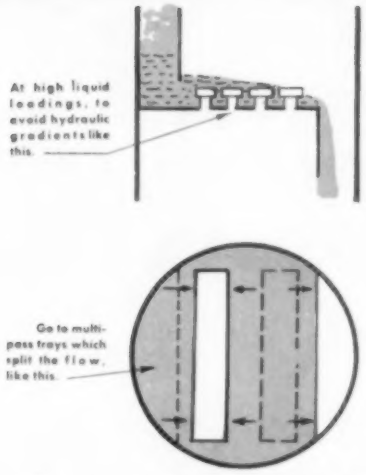
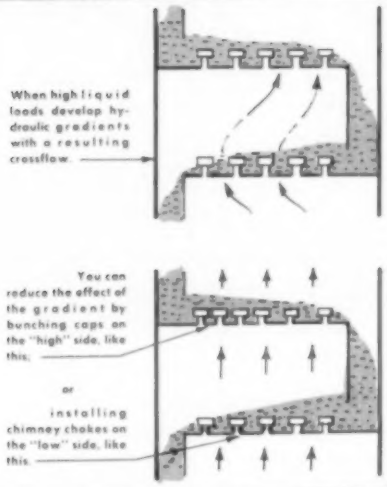
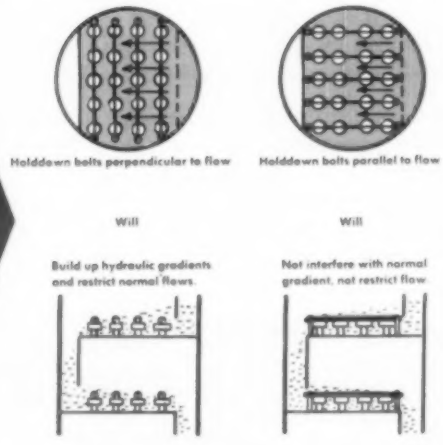
By Larry Resen
The Oil and Gas Journal's
Gulf Coast Processing Editor

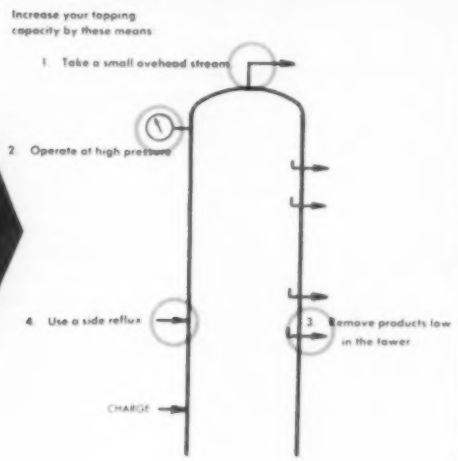
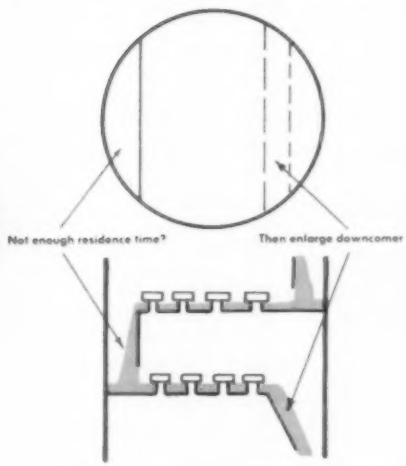
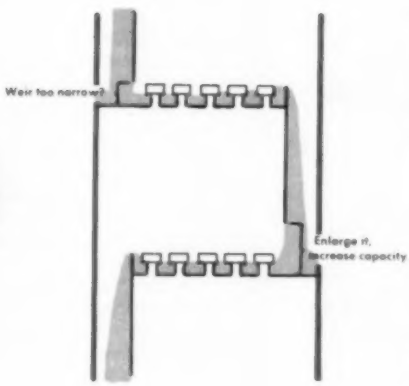
BOTTLENECK REMOVAL is to the engineer neither a science nor a craft. Rather, it's a hybrid—a semiengineering approach, liberally sprinkled with common sense, to the refiner's perpetual task of wringing out every last drop of capacity from his equipment with least cost, least effort and greatest realization.

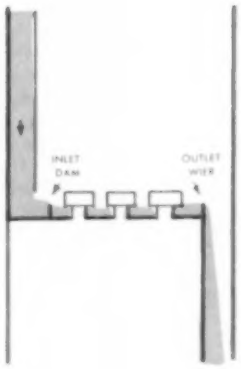
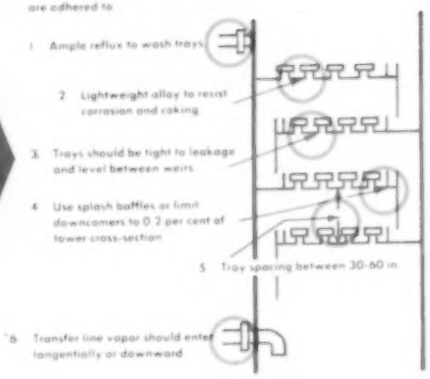
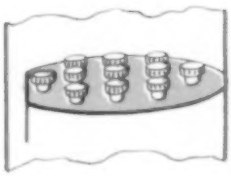
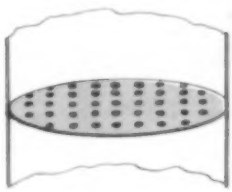
The very nature of the beast makes it self-perpetuating. Remove a bottleneck here, increase your flow substantially, and you create another bottleneck downstream. Remove this new bottleneck and behold another —maybe upstream, maybe downstream, maybe both.

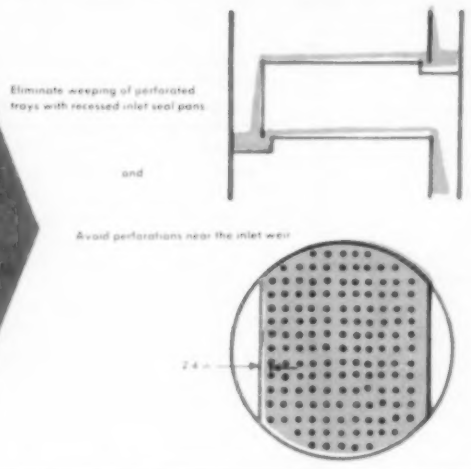
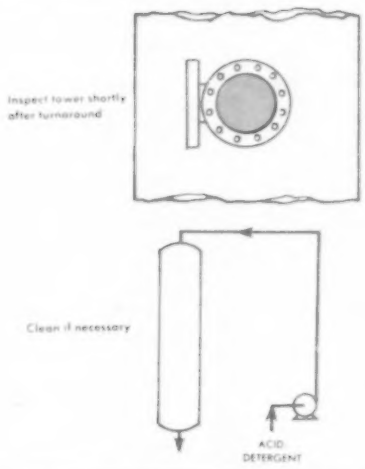
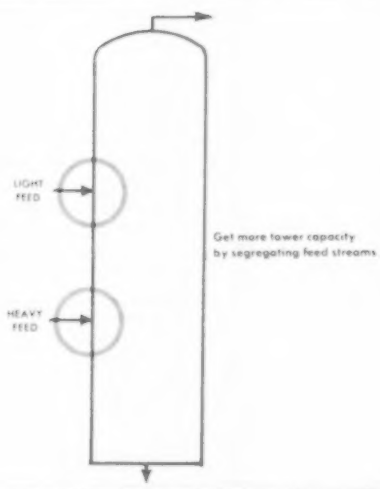
Aware of the continuing conditions thereby existing, the Journal has compiled some hints for the operating engineer, the technical service man, and perhaps even the designer. While each bottleneck has to be treated individually, this presentation may provide some clues to expedite bottleneck removal, and perhaps contribute to its important counterpart: Bottleneck Prevention.

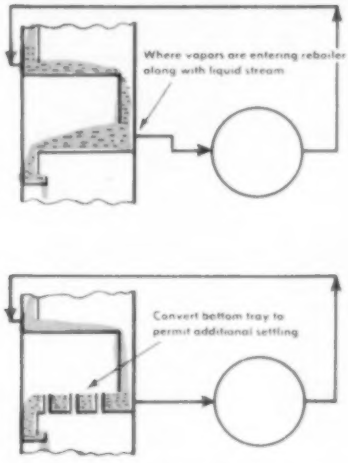
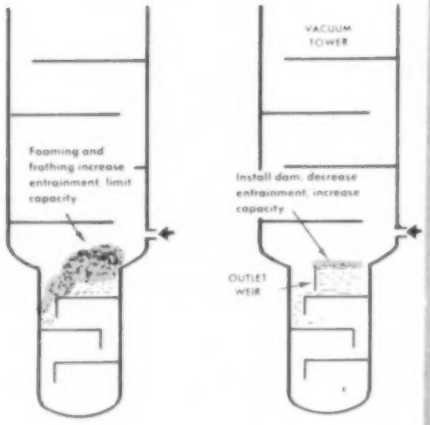
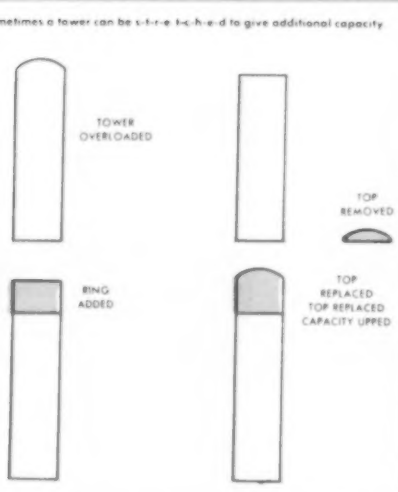
...a special feature of The OIL AND GAS JOURNAL

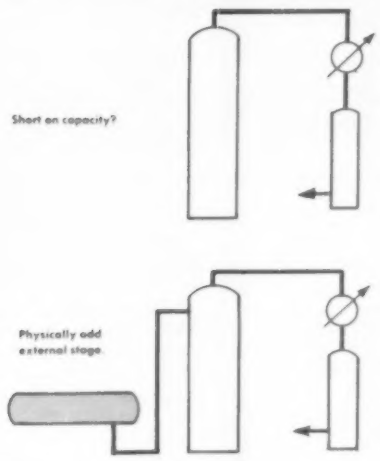
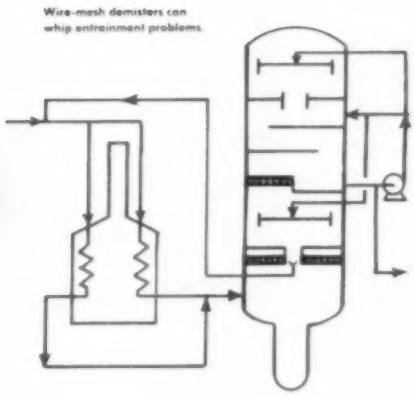
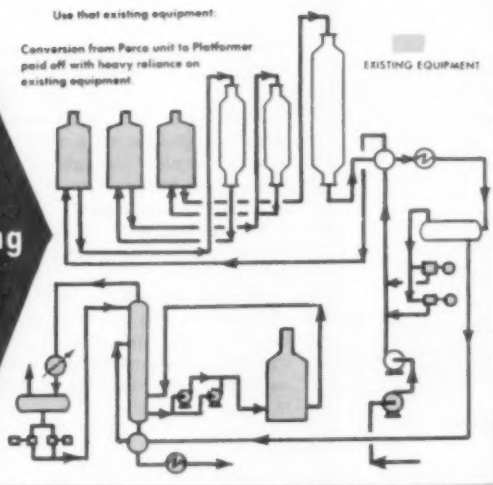
BOTTLENECK	DIAGRAM	REMEDY
High Liquid Loadings		Use multipass trays at high liquid loadings. Frequently pumparound circuits cause high liquid loadings on some trays. The main function of the pumparound is to transfer heat and not to perform fractionation. Since the heat removed from the pumparound streams results in some condensation, the liquid stream returned to the tower has a high volume. Multipass trays will help to offset the effect of high liquid loading. Since they are designed with two downcomers, increased handling of liquid is possible. Less holding time is a natural result of this along with less efficient fractionation. However, the trays present a practical approach to handling the high liquid loadings attendant with pump-around circuits.
Vapor Cross Flow		Avoid crossflow of vapor. Hydraulic gradients can be offset by proper spacing of bubble caps or use of chimney chokes. High liquid loading of trays accompanies high-capacity tower operation. This can result in a hydraulic gradient building up with a high liquid head near the downcomer, and the gradient diminishing across the tray into the tray outlet. Vapor passing upward through the tower follows the line of least resistance, and a crossflow is set up with the vapor zigzagging through the tower and bubbling up through only that part of each tray with a low liquid head. This crossflow can be eliminated by increasing the number of bubble caps beneath near the downcomer, thereby increasing the outlets for vapor in that part of the tray. Or chimney chokes can be installed on the low liquid portion of the tray. These chokes afford less free area for passage of vapor which will then redistribute itself evenly across the tray.
Flow Restrictions		Put holddown bars parallel to flow across trays. These holddown bars serve to prevent bubble caps from coming loose. However, if installed perpendicular to flow across tray they tend to restrict normal movement of liquid. Hence, a hydraulic gradient builds up, and proper liquid-vapor contact is not achieved. The simple solution is to arrange the bars parallel to the flow. Liquid movement will then be unimpeded by the bars. Caution: In all cases, whether holddown bars, J-bolts, or other devices are used to secure bubble caps, use lock nuts. Otherwise, the nuts will work loose over a period of time and wash into the downcomers, restricting normal flow in the tower.

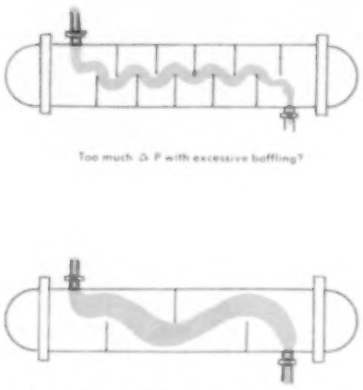
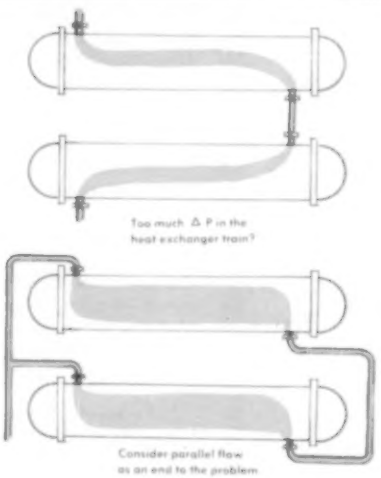
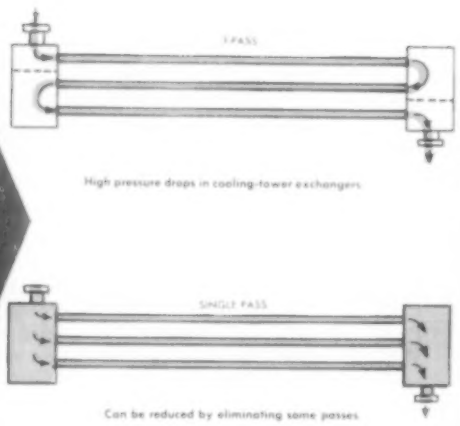
BOTTLENECK	DIAGRAM	REMEDY
Low Capacity	 Increase your topping capacity by these means 1. Take a small overhead stream 2. Operate at high pressure 4. Use a side reflux 3. Remove products low in the tower CHARGE	Tower capacity can usually be increased by operational changes or through use of minor connections: 1. An increase of tower pressure (within the tower's physical test limits) will result in significant capacity increases. Higer outlet temperatures will require additional pipe-still capacity. The potential gain will be limited somewhat by downcomer liquid capacity within the tower. 2. Use of side reflux to condense the reflux vapor before it reaches the top of the tower will permit a 10-15 per cent capacity gain. 3. Production of minimum overhead will permit overloading of the tower. A decrease of gasoline take will permit higher throughputs. 4. On some towers, low tower drawoffs will permit a 20-30 per cent overcapacity on the tower. The distillate and gas oil is withdrawn very low in the tower, leaving many plates between the distillate and kerosine drawoffs, thereby minimizing entrainment.
Short Residence		Insufficient residence time will limit tower loadings. Enlarged downcomers will increase this residence time. Where downcomers are too small, the residence time of the liquid passing down is limited. Frequently this results in a smaller head in the downcomer since the material in the downcomer is less dense due to the bubbles which haven't had a chance to escape. Not enough driving force exists under these conditions to carry the liquid uniformly across the tray. Downcomers may be enlarged several ways. Widening them at the top is a satisfactory method of providing ample opportunity for bubbles to escape through the resultant increased residence time. The tower may then be operated at increased rates with the proper liquid loadings of the tray.
Weir Choking		Check the inlet weirs on bubble-cap trays to see if they are limiting capacities. Bottlenecks frequently occur when the weir size is too narrow to permit enough oil to flow out of the downcomer onto the tray. Downcomer head meanwhile fluctuates due to bubbling and hence when a narrow weir is combined with an insufficient head the liquid is not pushed across the tray in sufficient quantities, thereby limiting capacity. If ½-1 in. is removed from the weir, the larger opening will permit higher capacities through the tower.

BOTTLENECK	DIAGRAM	REMEDY
Liquid Dumping	Inlet dam will reduce dumping on trays 	An inlet dam upstream of the first row of caps will prevent dumping of liquid to the tray below and improve distillation tower performance. When the energy in the liquid stream leaving the downcomer and entering the tray is greater than the vapor driving force across the caps, the liquid will dump to the tray below. The inlet dam prevents liquid from impinging on the caps and reduces the amount of vapor required to prevent dumping. In many cases it is actually impossible to make a tray dump when using a properly designed inlet dam. The location and the height of the dam must be given careful consideration for a given service. If these factors are not taken into account, the use of the dam can cause poor distribution of the liquid, and can decrease the capacity of the column.
Clogged Demisters	Bubble-cap trays will permit high vacuum tower rates without entrainment if these points are adhered to 	If you don't want to be bothered replacing coked-up wire mesh demisters, you can use bubble-cap trays and operate your vacuum tower at high rates if you: 1. Provide sufficient reflux to dilute and wash back entrainment from below. Two trays will give a better cleanup than one. 2. Use lightweight alloy for resistance against corrosion and coking. Trays should be tight to leakage and level between weirs. 3. Use splash baffles ahead of outlet weirs or else size the downcomers to be not larger than approximately 0.2 per cent of tower cross-sectional area. This is so the small amount of reflux will not be blown off the tray into the downcomer. 4. Direct the vapor from the transfer line either tangentially into the tower or downward with sufficient control over its distribution so that the liquid gets headed down instead of up. 5. Space your trays from 30 to 60 in. apart.
Limited Throughput	If bubble-cap trays are limiting throughput  Try perforated trays or one of a score of new designs 	If bubble-cap trays are limiting throughput, try perforated trays or one of a score of new designs. At the same vapor rate, liquid rate, and tray spacing, liquid entrainment between trays is less for perforated ones than for bubble caps. For a ⅛-in.-diameter-hole perforated tray, entrainment is one-sixth to one-tenth of that for a bubble-cap tray with 4¼-in.-diameter caps when both trays have same tray spacing and same length of liquid path. Data for 3/32-in.-diameter-hole trays show entrainment is one-third to one-twentieth of that with rectangular bubble-cap trays, depending on liquid and vapor rates. One debutanizer, designed on basis of bubble-cap trays, but later provided with perforated trays, has operated 20 per cent above original design, with no decrease in efficiency. As a general rule, however, bubble-cap trays have a wider range of capacity with good operating efficiency than perforated trays, and are preferable where operations may vary considerably.

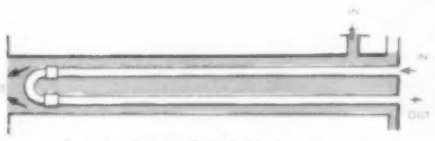
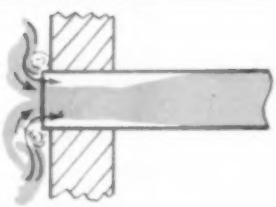
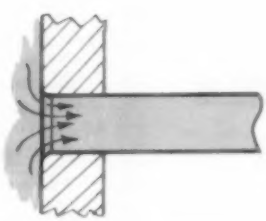
BOTTLENECK	DIAGRAM	REMEDY
Liquid Loadings		1. Recessed inlet seal pans will reduce weeping. In this design, the liquid flowing out of the downcomer has less tendency to fall and hence the tendency of the liquid to be driven through the holes on the tray at that point is reduced. Another advantage is that the recessed seal pans provide a deeper seal for downcomer backup. 2. Generally, sieve trays should not be perforated closer than 2-4 in. from the inlet weir. In cases of high liquid loadings, this undrilled space could be made even wider to help prevent impact weepage. 3. In fabrication of new towers, trays are deliberately tilted slightly to the outlet weir (about ⅛-¼-in.) to minimize hydraulic gradient effects. 4. Generally, 3/16-in. holes are the most desirable for commercial use. Smaller holes give better vapor-liquid contacting, with 3/16-in. almost as good as ⅛-in. holes. The ¼-in. holes—the cheapest to fabricate— give poorer vapor-liquid contacting due to wider spacing and a tendency for the vapor to jet through the liquid.
Rust and Sediment		Poor turnaround practices can create bottlenecks. Many towers and equipment will function poorly immediately following a turnaround due to rust and sediment deposits resulting from turnaround operations. Case in point: An isobutane tower and debutanizer tower in an alkylation unit were placed back on stream following turnaround. Isobutane tower inspected a month later showed 50 per cent of holes in first 12 trays were plugged, out of a total of 50 trays. The material was 85 per cent iron oxide. The trays were acid washed and the towers returned to service. Several months later the debutanizer was inspected; 70 per cent of the holes in the perforated trays were clogged with rust The tower was acid washed and returned to service. It has since operated 2 years troublefree. Moral: Inspect towers shortly following a turnaround. Wash with acid or detergent as required.
Low Tower Capacity		Stretch your tower capacity by segregating feed inputs wherever possible. You can then introduce these feed streams on trays most favorable for their distillation. Case in point: A deisobutanizer was operated to recover isobutane from two feed streams; one consisted of debutanizer overhead from an alkylation unit and the other a straight refinery isobutane charge stream. The debutanizer stream consisted of 75 per cent isobutane and the refinery stream consisted of about 25 per cent isobutane. The first stream was introduced high in the 85-tower on tray No. 26, while the low isobutane stream was introduced on tray No. 40. In both cases, the composition on the trays most nearly matched those of the incoming feed streams. Separation of components has been possible with fewer trays needed in following this method.

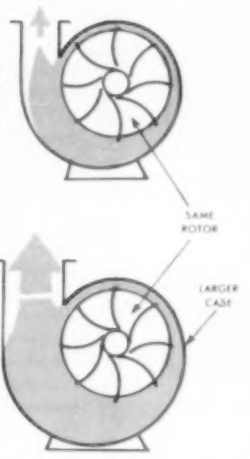
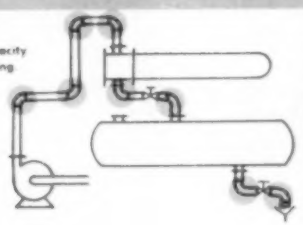
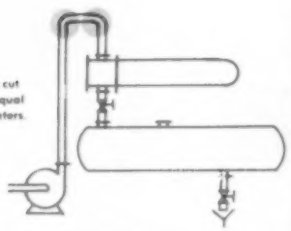
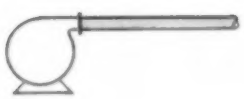
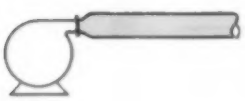
BOTTLENECK	DIAGRAM	REMEDY
Uneven Thermo-siphon		Reboiler bottlenecks can be caused when vapors upset thermoisphon cycle. You can control this by increasing settling time on the drawoff tray. Normal tray conditions will frequently permit vapor to enter inlet lines of a reboiler. Where a thermosiphon cycle is used, this vapor interferes with the normal differential head necessary to maintain proper flow rates through reboiler. The smaller head resulting from a vapor-liquid column reduces capacity through the reboiler and limits performance. The drawoff tray should be converted into an inactive fractionation tray. Installation of chimneys will permit vapor to escape upwards while liquid settles out and a constant head is maintained.
Foaming and Frothing		Reduce foaming and frothing in vacuum towers; thereby cut back on entrainment and increase capacity. The nature of vacuum-tower operation lends itself to considerable foaming and frothing. In the bottom section of the towers, this contributes to entrainment of heavy particles in the rising vapors. When this occurs beyond permissible limits, the operator has to cut back capacity or risk a dirty overhead stream. A dam across a tray in the lower section of a vacuum tower will do much to alleviate foaming and frothing. Installed with an open space between it and the tray, the dam provides a settling space for the heavy liquids. The outlet weir at its base permits liquid to be carried off to the downcomer. Meanwhile, vapors can escape from the heavy liquid during this settling time with minimum entrainment. The tower can be operated at higher capacity with this arrangement.
Short Tower		You can sometimes add a section to an existing tower to provide more capacity. Case in point: In one unit, crude capacity had been increased from 25,000 to 30,000 bbl. in early modifications. A rearrangement of heat exchangers made it possible to add an additional 10,000 bbl. to the throughput, but the fractionation tower was the limiting factor. This original tower consisted of a reduced steam stripping section containing 4 trays and the main fractionating section containing 12 trays. The charge to the tower is the bottom stream from a flash unit. The top of the tower was removed, a 16-ft. extension containing 8 trays was added to make a total of 20 trays in the fractionation section. The top of the tower was replaced above the new section. Net result: increased capacity was available to meet requirements and improved fractionation was an extra dividend.

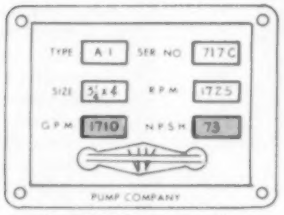
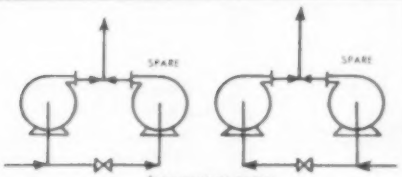
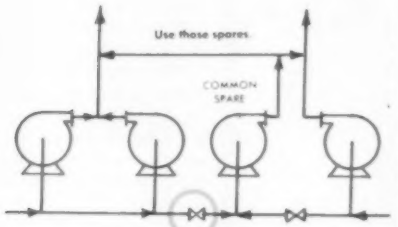
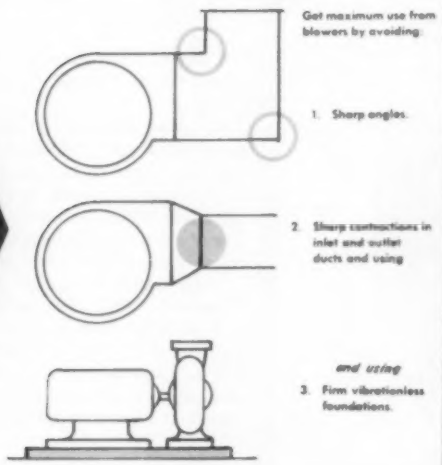
BOTTLENECK	DIAGRAM	REMEDY
Limited Capacity		Where possible, take the short economic road. Add a stage, rather than a unit. For instance, in liquid-liquid extraction towers, provide an external stage to increase your capacity. This extra stage can be simply a large-diameter drum. 1. You'll up your throughput by providing greater settling volume between discontinuous and continuous phases. 2. Youll increase mass-transfer efficiency and improve yield-quality relationship by adding an extra stage for contacting purposes.
Volume Entrainment		Try wire-mesh demisters. They'll knock out liquids and permit increased throughput with a clean gas-oil product. Cases in point: A vacuum tower with an original capacity of 12,000 bbl. had been increased to 20,000 bbl. Problem was how to increase this even more. Installation of wire-mesh permitted an increase to 26,000 bbl. with a slight improvement of product quality. The 4-in. pad had a 200-day life. In a smaller tower, charge stock was increased from around 2,750 bbl. to 4,200 bbl. with no effect upon product quality. Previously, a 3,000-bbl. charge would result in off-specification gas-oil overhead. The 4-in. pad had a 2-3-year life. Points to remember: 1. To avoid coking of the pad, consider a small gas-oil wash stream above the pad. 2. To avoid burnout of the wire mesh, wet it down with water during a turnaround. 3. Watch out for corrosion on holddown rings or clamps. Stainless-steel mesh will hold up well.
Revamping	 Use that existing equipment: Conversion from Perco unit to Platformer paid off with heavy reliance on existing equipment EXISTING EQUIPMENT	If you need a new process unit, consider conversion of existing facilities. Case in point: A plant requiring modern processing facilities converted an existing Perco cycloversion unit into a 2,500-bbl. Platformer. Most of the auxiliaries existing were suitable for platforming operation. For instance, initial charge passes through existing booster pump. New reactor charge pump moves liquid through three existing heaters retubed for the new service. New reactors and special piping were required. Output from the reactor section passes through new exchanger, condenser and separator. Overhead gas from separator passes through existing compressors and is recycled. Separator liquid is charged to existing column with new trays. Bottoms from the tower pass through existing reboiler. Tower overhead passes through existing condenser and accumulator and existing reflux pumps are used in process.

BOTTLENECK	DIAGRAM	REMEDY
Excessive Baffling		WITH PRESSURE DROP PLAYING SUCH AN IMPORTANT PART IN HEAT TRANSFER, YOU CAN IMPROVE YOUR EXISTING SETUP FREQUENTLY BY MAKING SEVERAL MODIFICATIONS. FOR INSTANCE: Check your internal baffling layout. In many designs, excessive baffling contributes to a high pressure drop through an exchanger. You can try cutting back on the baffles, maybe removing half of them, thereby making the free area within the exchanger greater. You won't necessarily get the same heat-transfer rate, but with a reduced pressure drop, you'll be in much better shape to add additional heat exchangers when your heat-transfer requirements expand to that point.
Exchange Flow		Where you have multiple exchangers in a process, you can always consider parallel flow over series flow. Again the evaluation here has to be whether it is best to reduce your temperature drop along with your pressure drop. Generally, the practical limiting factor in heat-exchanger operation is pressure-drop buildup. Hence, a few degrees loss in T is usually preferable to too much P. You get a plus factor in parallel flow; ability to conveniently pull off one exchanger at a time for cleaning and inspection without hampering normal operations.
Pressure Drop		Slight modifications can improve your situation. Case in point: Horizontal, three-pass coolers were used in a cooling tower with partitions in headers at each end to pass the incoming gas in series through three rows of tubes in each of the coolers. As plant throughput increased, design limits of the coolers were exceeded and serious pressure drops developed. The coolers were converted to single-pass, parallel jobs by drilling holes through the partions in each header. By eliminating the series flow, pressure drop declined from 111 psi. to 20 psi. in one unit and from 25 psi. to 6 psi. in a second unit. Increased throughput was adequately handled this way without an expensive addition to the cooling tower.

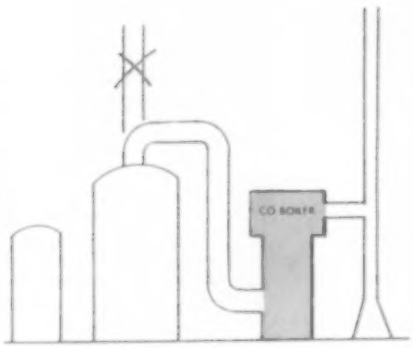
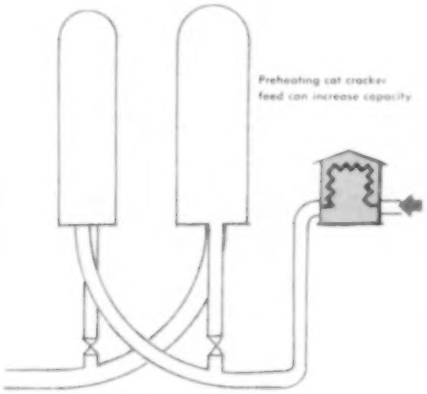
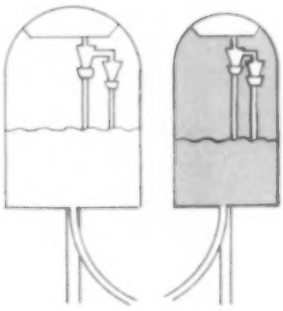
HEAT TRANSFER

BOTTLENECK	DIAGRAM	REMEDY
Poor Heat Transfer	 To increase heat transfer in double-pipe exchangers: Use fin tubes Or several tubes in one pipe	Get more work out of those double-pipe exchangers. You can do this by using several tubes in one outside pipe or shell, or you can use fin tubes. These double-pipe exchangers are handy because they provide almost perfect countercurrent flow, are composed of many small units which can be switched from service to service as conditions change, and can be cleaned one at a time without disturbing entire setup. Remember though, pressure drop becomes prohibitive for large installations with pure countercurrent flow. Too many multiple-stream arrangements, meanwhile, become similar to ordinary shell-and-tube exchangers and eliminate main advantages of double-pipe units.
Limited Capacity	Heat-transfer capacity low? Try extended surface types	If your unit is short on heat-exchanger capacity, try using extended surface tubes. In most installations, one of the fluids has a poorer heat-transfer rate than the other. Use more surface for the poor-rate fluid and overcome this bottleneck. Longitudinal fins should be used where fluid flow is parallel to the tubes. Use helical fins if flow is across the tubes. Finned tubes exhibit 4-5 times as much surface as a bare tube and fewer tubes are required. By proper use of the fins and careful routing of the fluids, transfer rates 50-75 per cent better than bare surface can be obtained.
High Turbulence	Reduce turbulence around tube ends and increase efficiency  By flaring tube ends at least 15 	Increase your effective heat-transfer capacity through your exchangers by aiming at streamlined flow and high efficiencies. You can do this by: 1. Flaring tube ends at an angle of at least 15°. This will facilitate streamlined flow, lessen turbulences, and reduce deteterioration of the tube ends. 2. Provide adequate crossover area in the channel and floating tubesheet cover. Specifically, the crossover area should be at least 25 per cent greater than the area of the larger of the two adjacent tube passes. 3. Sufficient baffling is needed to assure adequate support of the tubes along their length, thereby avoiding stresses. Recommended maximum, unsupported lengths are 52 and 60 in. for ¾-in. and 1-in. o.d. tubes, respectively.

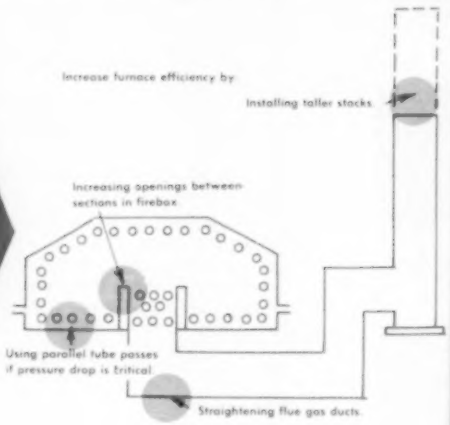
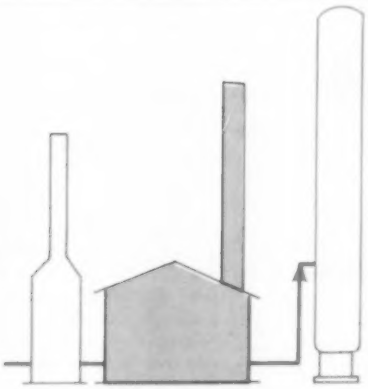
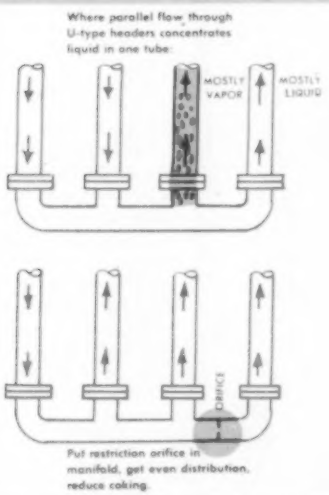
BOTTLENECK	DIAGRAM	REMEDY
Undersize Pumps	Don't get caught short on pump capacity. Begin by installing all pumps rated at least 120 per cent of design capacity.  On centrifugals, you can use oversized cases at first, increase rotor-vane sizes later.	Don't get caught short on pump capacity. Begin by installing ALL pumps rated at 120 per cent of design capacity. On centrifugals you can install oversized cases at first and later increase rotor-vane sizes as capacity requirements go up. Remember, when ordering pumps for a service, extra capacity cannot be considered as purely reserve capacity. Corrosion or erosion or necessity to open up wear-ring clearances may result in enough internal leakage to absorb a good portion of the extra-capacity provision. The per cent should be allocated for breakage and wear. Just providing for additional capacity does not always provide the reserve desired. Operating pressure of the pump must be considered for a turbine or motor drive to have sufficient power to handle increased capacity. In case of a fixed-pressure discharge, the driver would require the same percentage reserve as the pump itself.
Piping Resistance	Increase pump capacity by simplifying piping.  Six fewer elbows cut back on friction equal to 192 pipe diameters. 	Don't limit your pump capacity by needlessly complicating piping layouts. Best arrangement is to have simplest piping layout with minimum of valves and fittings. Case in point: Installing pipes with eight rather than two elbow fittings is equivalent to increasing the friction by an amount equivalent to pumping the fluid 192 pipe diameters on the average. A long-sweep elbow, meanwhile, is better than standard elbows to minimize pressure drops. Generally, a standard elbow will give you twice as much friction effect as a long-sweep.
Constrictions Hidden Output	 Pump capacity can be limited by narrow discharge piping.  Friction losses pyramid as the square of fluid velocity.	Narrow discharge piping can limit a pump's capacity. Friction losses pile up fast—as the square of the fluid velocity—and this factor should be weighed heavily when selecting the pump for the job. In case of a friction load on the pump, the pressure drop will increase with the square of velocity and the power with the cube of the capacity. Thus, a 10 per cent increase in pump capacity requires approximately 20 per cent increase in pump head and 30 per cent increase in driver horsepower. Different type valves will increase your pressure drop. A globe valve has a much higher friction effect than an angle valve which in turn has a much higher effect than a gate valve.

BOTTLENECK	DIAGRAM	REMEDY
Too Many Spares	Run performance curves.  Nameplate data can be misleading.	Don't overlook potential reserve capacity in existing pumps when removing bottlenecks. An existing pump, for instance, can operate satisfactorily at a slightly lower head and higher capacity if you increase piping size. A good practice is to run performance curves on existing equipment prior to a bottleneck-removal project. Frequently modifications have been made to the pumps and no notation made on records. Nameplate data will thus be misleading and you may have substantial reserve capacity in existing equipment.
Blower Blocks	 Long on spare pumps, short on capacity? 	Use those spares. Where you have a battery of pumps with numerous idle spares, consider doubling up on the spares to free some pumps for regular service. Some installations end up on spares and later find themselves short on capacity. A calculated-risk approach will frequently find many pumps which can be released for other duties. Caution: Where pumps are installed in parallel, carefully check head and capacity curves. Both must have a rising head curve and also must run at a common head. Curves don't have to be identical but must be similar. Avoid classic example of two pumps in parallel with one discharging into discharge of second pump because their curves crossed at a critical point.
Limited Preheat	 Get maximum use from blowers by avoiding. 1. Sharp angles. 2. Sharp contractions in inlet and outlet ducts and using and sizing 3. Firm vibrationless foundations.	Get maximum service from your blowers by: 1. Avoiding sharp angles in your ductwork. Smooth flow paths should be offered to the gas, especially in inlet and outlet ducts. Sharp angles and turns introduce eddy losses, decrease efficiency of the system, and increase horsepower requirements. 2. Avoiding sharp contractions in inlet and outlet ducts. These cause expansion-contraction energy losses, decrease efficiency, and increase power requirements. 3. Using solid foundations and supports to minimize vibration, thereby reducing wear to fan and surrounding equipment.

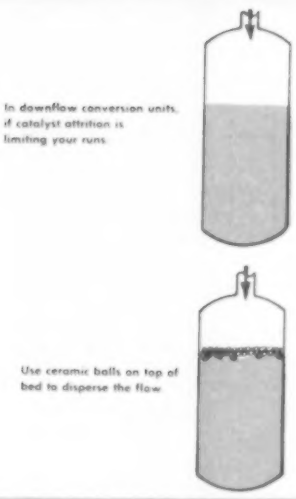
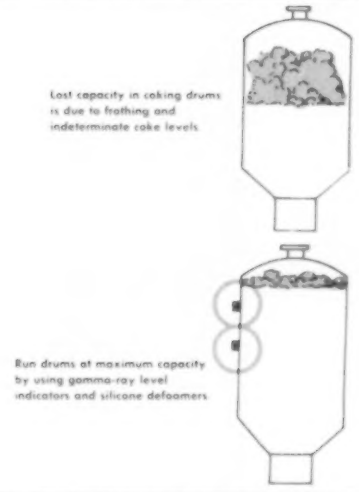
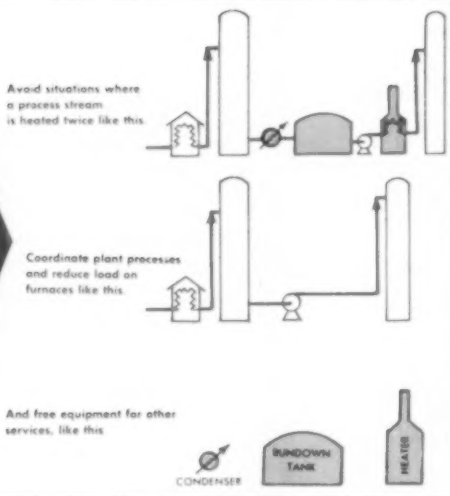
CAT CRACKING

BOTTLENECK	DIAGRAM	REMEDY
Increased Preheat	 Use CO boiler to increase steam capacity	The effect of increasing feed preheat is quite marked. Some examples: Increasing feed preheat from 380° to 500° F. decreased coke yield on one unit from 6.4 to 5.3 per cent and increased the fresh-feed rate from 14,750 to 17,300 bbl. per day. The coke yield decreased 21 per cent and feed rate increased 17.5 per cent. In another plant with synthetic catalyst, feed preheat was increased from 280° to 412°. Coke yield decreased from 7.3 to 5.8 weight per cent, down 26 per cent. A third plant using natural catalyst brought its coke yield down 28½ per cent, from 6.75 to 5.25 weight per cent by increasing preheat from 435 to 629 degrees. One company reports that a decreasing in preheat from 600° to 400° F. will result in a 33 per cent loss in capacity. Suggestions: Minimum preheat for any heat balance unit should be in the order of 500°-600° F.
Unburned CO	 Preheating cat cracker feed can increase capacity	Increase your steam capacity by installing carbon monoxide boilers on your cat crackers. In nonheat-balance units unburned carbon monoxide in the regenerator flue gas represents a source of considerable energy. On one unit approximately 400,000 lb. per hour pf 550-psig. 750° F. steam production was obtained by installing a CO boiler. Heat input to the boiler comes both from the sensible heat and the heat of combustion of the carbon monoxide, plus the heat from the supplementary fuel required to burn the carbon monoxide to the dioxide. The steam production resulting is greater than required to turbine drive all pumps and blowers on the unit and make it entirely free from upsets in outside sources of steam and energy.
Slurry Settler	Install a second set of reactor cyclones or slurry settler, and increase capacity 	A second set of reactors or a slurry settler will permit you to increase your fluid-cracking capacity. Recycling of heavier-cycle stock fractions has a marked effect on unit capacity, primarily due to coke yields and resultant air requirements. When recycling up to 3-5 per cent of fractionator bottoms, unit capacity will be reduced 15-18 per cent. Use of a slurry settler, however, will normally increase unit capacity by 8-10 per cent. The ultimate saving that can be realized is by completely eliminating the return of the heavy ends of the fractionator tower bottoms by installing a second stage of cyclones in the reactor. While a single set will eliminate about 90 per cent of catalyst carryover, the second stage will eliminate an additional 80 per cent of the carryover.

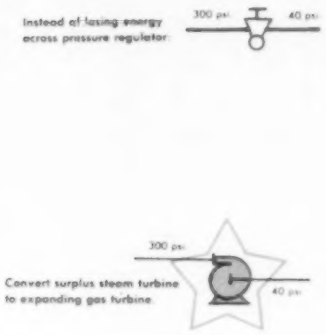
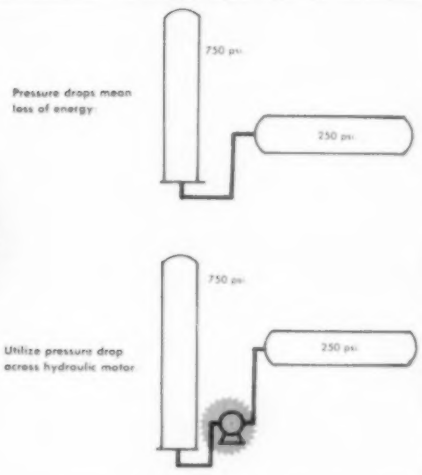
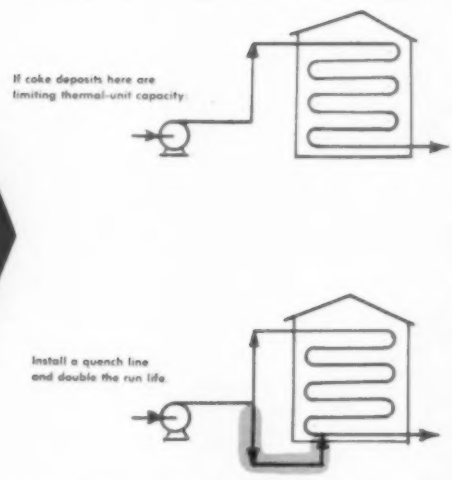
FURNACES

BOTTLENECK	DIAGRAM	REMEDY
Increasing Efficiencies		You can increase furnace efficiencies by: 1. Installing taller stacks to increase furnace draft. Be sure to provide proper guy-wire supports in this case. 2. Straightening flue-gas ducts. This is the same story of avoiding unnecessary pressure drops by providing smooth flow paths. 3. Minimizing the flue-gas pressure drop between radiant and convection sections in box-type furnaces by increasing the size of the openings in the furnace firewall. You may want to rearrange baffling to avoid pressure-drop problems. 4. Use parallel tube passes instead of series flow with flow regulation of each pass for good control where pressure drop is a limitation. 5. In some cases for box-type furnaces, remove the center wall in the furnace to provide additional combustion volume, to improve combustion by eliminating eddies in the flame front, and by minimizing flue-gas recirculation.
Insufficient Heat		You can boost furnace heat input by: 1. Enlarging the burners and adding convection section tubes in parallel passes. You have to consider coke-laydown limitations with lower velocities, however. 2. Using air-injection burners with secondary air supply instead of burners with 100 per cent aspiration. This permits more air to be injected into the furnace. 3. Supplementing existing facilities with on-the-shelf furnaces available from several manufacturers. These small units can give you additional process heat and/or replace reboilers. They take up little space and can be installed with a minimum of trouble.
Slow Down Coking		Eliminate those bottlenecks caused by coke buildup. You can eliminate rapid coke buildup in pipe still tubes by modified piping arrangements. Parallel flow through U-type headers frequently results in a high rate of coking since flow is unevenly distributed through the outside tube, with a high vapor rate passing through the inside tube. A restriction orifice in the manifold between the two return tubes will even out the distribution. By breaking up the centrifugal action, flow is properly distributed between the tubes and high coke buildup is avoided.

CAT CRACKING, HEAT SAVING

BOTTLENECK	DIAGRAM	REMEDY
Catalyst Loss		Don't let catalyst attrition become a bottleneck to your operations. You can use a ceramic "shield" to protect catalyst in fixed-bed units from the incoming stream. In downflow conversion unit reactors, incoming process streams tend to jet into the catalyst bed, thereby damaging catalyst particles and limiting the length of runs. Use of a narrow bed of small ceramic balls on top of the catalyst bed will protect the catalyst. The balls will disperse the incoming flow and reduce catalyst attrition. The inert ceramic material will not interfere with the normal process reaction.
Frothing		You can do this by using gamma ray level indicators and silicone defoamers. Determination of coke levels in coke drums has long been a rude-of-thumb guessing game. Considerable frothing within the drum has contributed to this difficulty. As a result, operators have either run units below capacity or tried to estimate levels, frequently resulting in contamination of overhead streams. Maximum coke production can be closely approached through use of gamma-ray emitting instruments using a cobalt 60 source. The radioactive source is attached to the drum and rays emitted pass through the drum and are picked up by a receiver. In this manner, actual coke levels can be determined, as well as the froth level. The unit can then be operated to maximum capacity by holding froth level below drum outlet. Addition of silicone defoamer compound, meanwhile, will reduce amount of frothing within the drum, thereby increasing net capacity for production of coke.
Heat Saving		Use your heat to fullest advantage. You can do this by tying units more closely together. Rather than turn a hot stream into a rundown tank, see if it can be handled by direct flow to the next unit in the process. You'll gain several advantages. The condenser used to cool the stream will be free for service, the rundown tank can be put to other use, and the furnace used to reheat the process stream will have capacity to spare. A fuel savings will also be realized in these cases.

ENERGY SAVING, COKING

BOTTLENECK	DIAGRAM	REMEDY
Energy Loss		Utilize latent energy in high-pressure plant gas streams. You can do this by using expanding gas turbines to take pressure drops. Case in point: At one plant, 15 M.M.c.f. of residue gas is used in the plant's fuel system. This has to be reduced from 300 psi. to about 45-50 psi. before entering the fuel lines. A stream turbine was modified into an expanding gas turbine. This was done by the addition of carbon rings and by changing the vanes slightly on the turbine rings so they would operate on the expanding gas. Previously lost energy from the fuel-gas pressure drop is now used in driving a pump.
Pressure Drop		Increase your energy sources by using process stream pressure drops. You can do this by taking the pressure drop across a hydraulic motor. In one gas plant, the 750-psig. rich-oil stream from the main absorber is reduced to 250 psig. in a flash-tank sequence. This differential of 500 psi. involves considerable energy that was normally wasted by dissipation across a control valve. This energy is now recovered by taking the pressure drop across a hydraulic motor coupled directly to a hydraulic pump. The power recovered is used to pump lean absorption oil to the reabsorber. A plus valve with hydraulic units: It has wide range, capacity-head characteristics. Consequently, it could serve as a multiple standby unit for several varying services.
Limit Coking		Use quench lines to limit coke deposits, improve operating capacity. The last tube or two in thermal units can be a critical area for coke laydown. As these deposits increase, the pressure drop will build up, limiting the throughput and onstream time of the heater. A quench line running from the discharge of the charge pump can be tied in upstream of the heater tubes where coke laydown is most severe. Coke laydown will be minimized and pressure-drop buildup will be gradual rather than rapid. Run life can be easily doubled this way.

Here's a brief list of some DON'Ts

Oldtimers around a plant will tell you there are some bottlenecks to be removed and some bottlenecks to be left. Invariably, they say, a new engineer reporting to technical services for the first time will latch onto a flow sheet and come up with numerous bottleneck-removal projects. More often than not, the oldtimer says, the unit in question will have been already worked over so many times, that the only real bottleneck will be in the time it takes to explain why no more bottlenecks actually remain. Hence, this list of don'ts:

Don't limit your bottleneck search to one unit in a train. Frequently an obvious bottleneck has to remain—at least temporarily—until a downstream bottleneck has been removed.

Don't create downstream bottlenecks. If you increase fractionating capacity without providing for additional accumulating or condensing capacity, you'll simply shift the bottleneck slightly, with no real gain.

Don't reject the possibility of a completely new unit. A relatively inexpensive bottleneck-removal project might save you money on the short haul, but if it's a real old unit it might pay you to invest a little more and get a newer, more efficient unit for the long haul.

Don't assume those before you were complete ignoramuses and missed several obvious bottlenecks. Usually there was a reason. Before you proceed with modifications, better check around on why it wasn't done previously.

Don't overlook the side effects a bottleneck removal might create. Higher temperatures might weaken furnace tubes, for instance, or higher pressure might be bad for a pump housing. Check carefully before proceeding.

Don't forget that maintenance crews must have room to work in. You might stack additional exchangers in a unit and get plenty of needed heat. But you might also hamper future turnaround crews. Check those clearances carefully.

Don't forget those offsite facilities. A higher throughput means more storage facilities. Be sure to provide for these as well as other accessories.

Don't overlook the need for additional drain lines and sewer lines when expanding a unit. Limited capacities here can give you lots of future trouble, if you don't provide for anticipated volumes.

Don't forget that economic conditions are always changing. Concentrate on bottleneck removals which will give the most return. Visbreakers, for instance, are passing out of the picture, so it is better to concentrate on improving alkylate production to help you keep up with the octane race.

Don't overlook the safety factor. In trying to squeeze additional equipment into a limited area, you may find yourself creating a safety hazard. Watch it closely.

Don't forget that a setup in pump capacity isn't always the complete answer. Higher velocities can contribute to higher erosion and corrosion rates.

Don't forget to incorporate your bottleneck-removal projects in the design of your newer units. Take advantage of your plantwide experience when building new facilities.

Don't do your bottleneck-removal projects piecemeal if you can help it. Several minor changes in the same area of the unit are better done all at once. Otherwise you'll be duplicating work, such as erecting scaffolding, removing or altering flow lines, etc.

Don't forget your optimum operating conditions. If added throughput will knock your efficiency way down, or mess up your product quality, it is best to leave the unit be.

Don't overlook those meter runs with higher throughputs. If increased capacities require maximum orifice sizes with existing meter runs, you'd better increase those runs. You can lose a lot of efficiency if they're not on the button.

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ROCKWELL-Nordstrom VALVES

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FOUR WAYS IN WHICH ROCKWELL EXCELS

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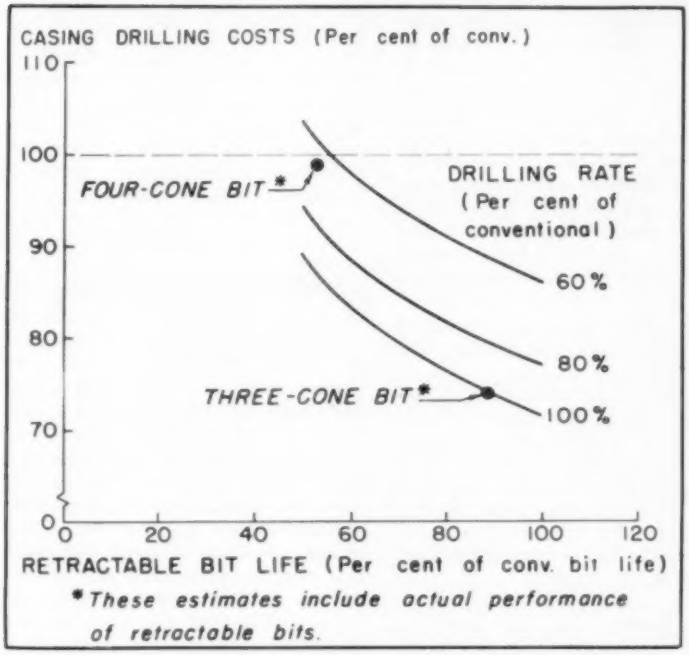
ROCKWELL GAS METERS AND REGULATORS

Drilling with casing and wire-line retractable rock bits indicates you can

Save up to 25 per cent on 7,500-ft. well

. . . and with deeper holes the savings should increase because trip time increases

By J. M. Camp, J. E. Ortloff, and R. H. Blood



ESTIMATING DRILLING COSTS for 7,500-ft. wells using retractable bits with casing. Fig. 1.

A STUDY of drilling with casing and retractable rock bits shows savings of up to 25 per cent of conventional drilling costs on a 7,500-ft. Mid-Continent well. Fig. 1 shows the estimated cost of drilling with casing as a percentage of conventional drilling cost under various drilling conditions.

Predicted savings for casing drilling are based on reductions in time, equipment, investment, and labor resulting from the elimination of trips with drill pipe to change bits. Reduced equipment investment is considered possible because the need for high-powered, high-speed hoisting equipment to make rapid round trips is eliminated.

The only such equipment required is that for adding single stands of pipe or for handling occasional emergency pulling operations at slow speed.

System details . . . In the drilling system analyzed, 7-in. o.d. streamlined casing was selected for the drill string. Two retractable rock bit designs were considered—a four-cone, and a three-cone. The bits pass in a collapsed position through the casing bore and then expand to cut a hole large enough (9¾-in. diameter) to pass the casing. The bits are transported in and out of the hole by a swabbing or sand line.

Authors are with Carter Oil Co., Tulsa. Paper presented at A.S.M.E. Petroleum-Mechanical Conference, September 22-25, 1957, Tulsa.

Since round trips with pipe are not required, it was assumed that the mast for adding single casing joints would be shorter than standard length, and that less hoisting power would be required. One crew man would be eliminated. Rotation and circulation would be conventional except that a special casing drive would replace the standard rotary kelly and bushing.

Development of a four-cone retractable bit was started first, and later the three-cone bit was built. The cutters and cutter legs for both retractable bits were manufactured by Hughes Tool Co., The upper mandrel assembly and sinker bar for the four-cone type were made by Houston Oil Field Materials Co.

Operation of the four-cone bit . . . The four-cone bit was designed to carry the collapsed cutters in pairs for making round trips. Fig. 2 shows the special drill collar receiving the bit. When the two spring dogs contact a shoulder near the bottom of the drill collar, they stop the downward movement of the two center cutters.

A sinker bar at the top of the bit pushes the two hinged outer cutters against a wedge (supported by the dogs) and the wedge in turn forces the outer cutters to gage diameter. At the same time the heavy spring is compressed and the upper latching dogs are carried past a downward-facing shoulder near the upper end of the bit assembly.

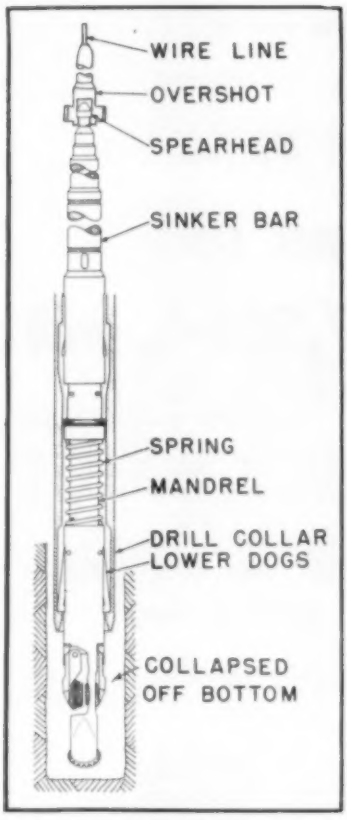
A seal is expanded to fit the bore of the drill collar. The overshot, which is attached to the cable, is released from the bit spearhead when a tripping sleeve is dropped down the cable from the surface. The cable is then reeled from the well.

The casing is lowered until the bit reaches bottom and the upper dogs carry the drilling weight as shown in Fig. 3. A drive lug, extending downward from the upper shoulder transmits drilling torque through one of the upper dogs to rotate the bit.

Mud coming down the casing bore is diverted by the seal through ports and down the center of the bit body. The stream is divided into two jets which strike the bottom of the well between the outer and inner cones.

Wornout bits are replaced by reversing this procedure. The casing is picked up enough to permit the surface connection to be broken and the pipe to be hung in the slips. The cable and overshot are lowered over the spearhead and the collapsed bit is pulled to the surface.

Operation of three-cone bit . . . The three-cone bit was designed to use the largest cones that could possibly pass through the bore of the casing.



SPECIAL DRILL COLLAR is used to receive the four-cone retractable bit. Fig. 2.

To do this, the cones are arranged in single-file when the bit is collapsed. Fig. 4 shows the bit collapsed in a cutaway view of the special drill collar designed to receive the bit. Also in Fig. 4 the bit is shown expanded to full drilling diameter.

The bit is lowered on a cable and special overshot through the casing. Each cone is stopped successively by contact of separate spring-loaded dogs in the locking recess. Thus all three cones are positioned at the lower end of the drill collar. The heavy central mandrel (to which the cone carriers are slidably attached) continues downward to wedge the cone legs outward against the lower end of the drill collar bore.

Corrugations (or splines) in the casing core engage the outside of the cone legs to transmit torque directly from the drill collar to the bit. Thus a direct method is provided for driving the three-cone retractable bit. For the four-cone bit, dogs transmit torque and weight into the mandrel several feet above the cutters.

An expanding packer is held down by two latching dogs (not shown in the figure) near the upper end of the bit assembly. The packer diverts drilling mud through the bore of the mandrel and out through a nozzle at the lower end. The fluid jets the bottom of the hole slightly off center.

The overshot will not release the bit spearhead until the upper dogs are seated in the recess of the drill collar.

TABLE 1

Test	Field	Per cent of conventional: Average drilling rate	Per cent of conventional: Average footage
1	Searight	90	66
2*	Northwest Perry		
3	Seminole	55	53
5	Konawa	67	36
5	Seminole	41	46
	Total average	65	55

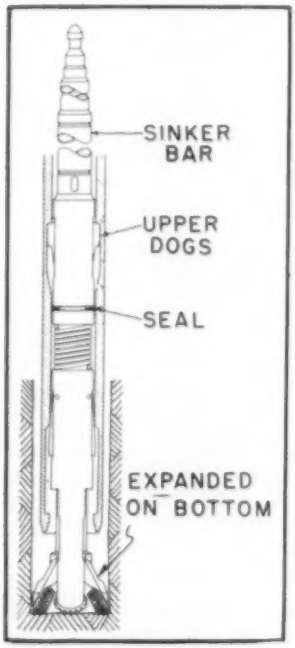
*Insufficient hole was drilled during this test to determine comparative drilling rate and bit life.

Bit Tests

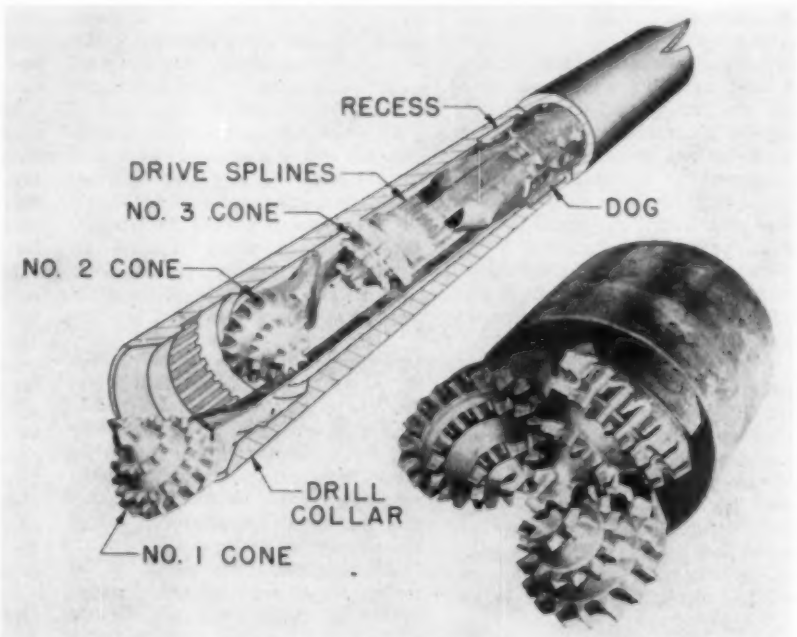
The four-cone bit was field tested five times, and drilled a total of 1,142 ft. of hole. Modifications were made as weaknesses showed up during the course of the field tests. Some of the major difficulties were sand deposit and sand erosion near the seal, nozzle erosion, inability to ream undersize hole and tool-joint weakness in the mandrel. With these defects corrected the retraction and expansion of the bit became quite reliable.

During most of the tests drilling weights and rotating speeds were about the same as those for conventional drilling in the test areas near Seminole, Okla.

Table 1 shows the average drilling rate and average bit lift of the four-cone bits for each field test. These are expressed in per cent of conven-



BIT ON BOTTOM—Casing is lowered until bit reaches bottom. Fig. 3.



THREE-CONE BIT was designed to use the largest cones that could pass through the bore of the casing. Cutaway view shows special drill collar. Fig. 4.

tional bit performance in the same area.

The generally low performance level of the four-cone bit was the result of the small size of the cones as compared with that of standard bit cones for the same 9¾-in. hole size. The cutter size determines the size and load capacity of bearings, the number and size of teeth, and the strength of the cone shell. Thus unit load and resultant wear are higher per tooth in the smaller cones.

Three-cone tests . . . The three-cone bit was laboratory tested by the bit manufacturer before field drilling tests were made. In these tests the bit was compared with conventional tricone bits, both being run in the same rock and at the same weight and speed. Drilling rates were equal.

In a bearing-life test, run on a steel block in drilling mud, the retractable bit ran at 60 r.p.m. for 45 hours at loads that totaled 657.5 ton-hours. Broken and damaged bearings in two of the cones stopped the bearing life test.

The three-cone bit was field tested twice near Seminole, Okla., during which 421 ft. of hole were drilled at rotary speeds and drilling weights commonly used in the area.

Mechanical trouble occurred mostly with the expansion of the bit. In one instance the third cone would not go entirely into drilling position because the casing was lying against one side of the hole. This prevented proper expansion of the first two cutters to make room for the third. Suitable centralizers were added to correct this trouble.

In a later test one of the positioning dogs passed the drill-collar recess and the cone protruded below the other two cones. When the bit was set on bottom and rotated, the cone and carrier were damaged. Later trials in the drilling laboratory showed this trouble to be caused by a dash-pot action that retarded the movement of the positioning dog. This difficulty was readily remedied.

Table 2 shows the average drilling rate and bit life of the three-cone bits, calculated from field tests. Again, these are shown as per cent of conventional bit performance in the same area.

The three-cone retractable-bit performance compares very favorably with that of conventional tricone bits. This is attributed to the relatively large size of the cones in this model, which approach conventional cone size. Although a slightly higher drilling rate was recorded, the amount of hole drilled was limited. The drilling rate is therefore considered equal to conventional.

TABLE 2

Test	Field	Per cent of conventional: Average drilling rate	Per cent of conventional: Average footage*
1	North Earlsboro	102	92
2	Seminole	120	87
	Total average	111	89

*Based on engineers' estimates of partially worn retractable bits.

Status of development . . . It was felt that after having proved field operability, any further development could be done more efficiently by an organization equipped for specialized machining and metallurgy work. Both retractable bit designs have been licensed to a major bit manufacturer on a nonexclusive basis.

Applications of the Principle

Economic analysis of retractable bits as shown in Fig. 1 was based mainly on their use as a means of drilling wells to producing depths without the time loss of round trips or the costly rigs necessary for frequent trips. Also, conventional hole size and essentially conventional practice were assumed.

Several extended uses have been suggested. Drilling down surface casing in areas of caving surface formation is one. Slim-hole drilling with nonroller cutter retractable bits (to eliminate the bearing problem) is another. Retractable diamond-bit cutters are a possibility. Another possible field of use is in conjunction with reelable downhole powered drills driven by fluid power, electrical energy, or otherwise.

Results and conclusions . . . Economic studies based on conventional Mid-Continent well costs indicate that the three-cone retractable bit, under proper conditions, could save about 25 per cent of penetration costs in 7,500-ft. drilling.

The savings to be expected from drilling with casing should increase with depth, because trip time increases. In wells shallower than about 4,500 ft. the streamlined drill casing must be replaced by cheaper A.P.I. casing to save money.

The development work done so far has produced reasonably workable bits that stand a good chance of practical usage. To fully realize the economic benefits of drilling with casing, surface equipment should be tailored for the process. Development of additional uses for retractable bit mechanisms is recommended.

Acknowledgments . . . Appreciation is expressd by the authors to Carter Oil Co. for permission to publish this paper on the basis of a company research project. The contributions of research engineers A. B. Hildebrandt, J. M. Kellner, and W. A. Freeman are also acknowledged.

Hughes Tool Co. and Houston Oil Field Materials Co., Inc., extended excellent cooperation in the design and manufacture of components of the retractable bits. **End.**

Nelson Refinery-Construction Index

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, Petroleum Refinery Consultant, Tulsa.

The Index was explained October 1, 1956, (page 110) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issue of the months of January, April, July, and October.

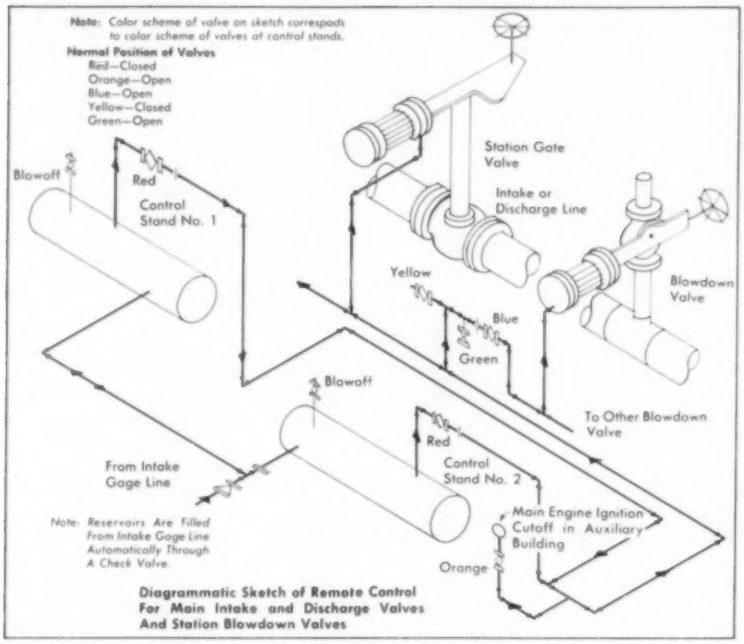
	Index (1946 = 100)					
	1949	1952	1954	1955	1956	June 1957
Pumps, compressors, etc.	135.9	155.6	166.5	172.2	192.0	203.7
Electrical machinery	130.9	152.4	160.0	162.5	175.0	187.9
Internal-combustion engines	124.8	146.5	150.5	153.2	164.0	173.5
Instruments	123.1	146.2	154.6	162.9	182.1	186.2
Heat exchangers	133.0	165.8	171.7	156.8	190.7	209.0
Miscellaneous equipment average	*121.6	153.3	160.7	161.5	180.5	192.1
Materials component	143.6	164.3	174.6	176.1	190.4	201.4
Labor component	137.1	163.1	183.3	189.6	198.2	208.1
Nelson construction index	139.7	163.6	179.8	184.2	195.3	205.4

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

Compressor Stations Go Modern in a five-point program by Natural Gas Pipeline. Result: Advantage taken of technological advances to improve operating economy

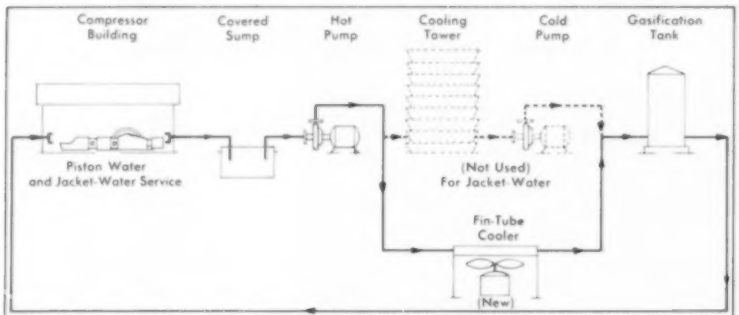
By M. J. Paul

1. Remotely controlled blowdown systems



Diagrammatic Sketch of Remote Control For Main Intake and Discharge Valves And Station Blowdown Valves

2. Modified closed water-cooling systems



Modified Engine Water-Cooling System

FIVE major modernization programs have been undertaken by Natural Gas Pipeline Co. of America in recent years. They are:

- Remotely controlled blowdown systems.
- Modified closed water - cooling systems.
- Supercharging compressor engines.
- Exhaust tuning of auxiliary engines.
- Exposure of manifold piping.

Each program is described in broad terms, which include reasons the projects came into being, scope of the work undertaken in each project, and the effect on our operating conditions. With these modernization programs, we have been able to improve operating efficiency, better operating conditions, promote safety, and increase fuel economy.

Natural Gas Pipeline in 1929 and 1930 constructed the first long-distance large-diameter high-pressure natural - gas - transmission pipeline from Panhandle field of Texas to the terminus at Joliet, Ill., a distance of 847 miles. To maintain flow efficiency, one field station and nine compressor stations were constructed. One additional field station and one main-line station were added later on as flow rates were increased.

These stations are all self-sufficient, having their own electricity, fuel, and water facilities, a separate communications system between stations, and living quarters for all key operating personnel. They were constructed to incorporate the latest engineering thinking of that day and operated as efficiently as could be expected from the kind of equipment then in service.

Remotely Controlled Blowdown System

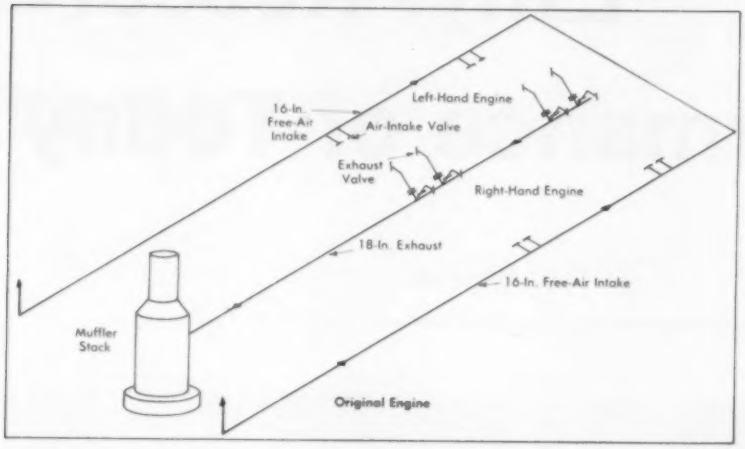
A measure of the success of our work is reflected in the safety which we provide for our operators as well as protection for equipment. A significant advancement of these precautions at our compressor stations has been the installation of a remotely controlled blowdown system.

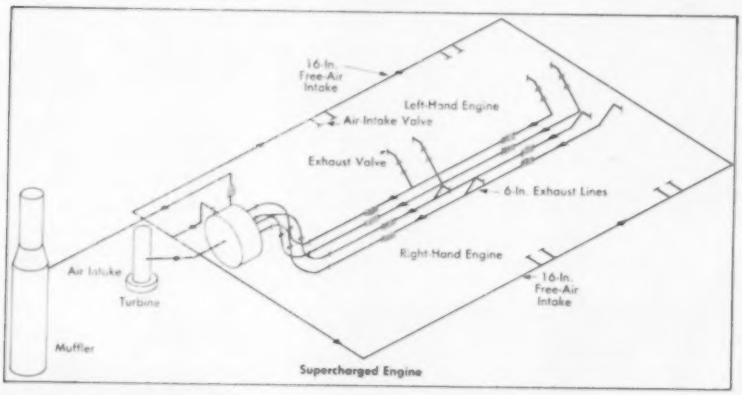
As originally conceived, the design of Natural's compressor stations called for remotely controlled suction and discharge block valves at each station to isolate it from the pipeline in the event of piping or equipment failure and to permit revision of station piping. It became obvious that in the event of fire the gas which would be trapped in the station could cause considerable damage by burning. A method of releasing this gas at a location of least hazard was desirable.

It was decided that the blowdown

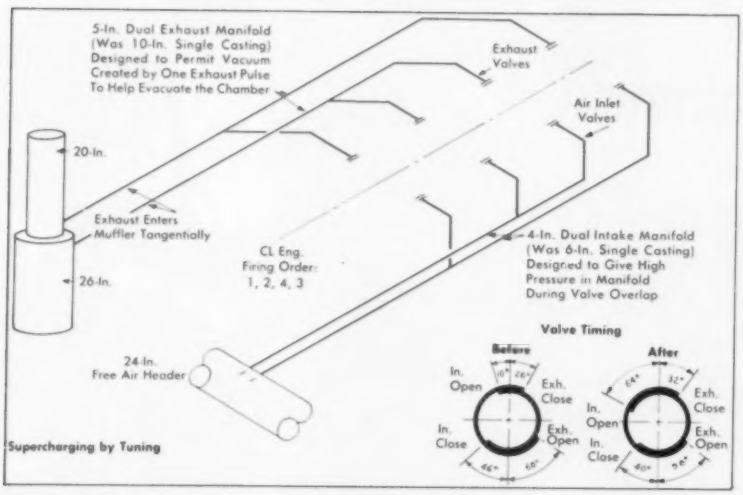
Author is chief engineer, Natural Gas Pipeline Co. of America. Paper presented at A.S.M.E. Petroleum Mechanical Conference, September 22-25, 1957, Tulsa.

3. Supercharging compressor engines





4. Exhaust tuning of auxiliary engines


5-In. Dual Exhaust Manifold (Was 10-In. Single Casting) Designed to Permit Vacuum Created by One Exhaust Pulse To Help Evacuate the Chamber
Exhaust Valves
Air Inlet Valves
20-In.
Exhaust Enters Muffler Tangentially
26-In.
CI. Eng. Firing Order: 1, 2, 4, 3
4-In. Dual Intake Manifold (Was 6-In. Single Casting) Designed to Give High Pressure in Manifold During Valve Overlap
24-In. Free Air Header
Valve Timing
Before
After
In. Open
Exh. Close
In. Close
Exh. Open
Supercharging by Tuning

5. Exposure of manifold piping . . .

. . . to aid inspection, simplify repair and maintenance, and eliminate electrolytic corrosion. Simplification of newer piping has helped improve operating conditions.

system should vent all the high-pressure gas in 1 minute or less at a selected remote point. These valves are operated pneumatically by a piston connected to rack and segment gears on the valve stem. Control stands at strategic locations in the plant area control the flow of gas under pressure from a permanent reservoir to the pistons which quickly close the suction and discharge block valves, and cause the blowdown valves to open within 10 seconds even though they may be 1,000 ft. away.

System details . . . In the design of the Texas Illinois system, a recently constructed affiliate, a remotely controlled blowdown arrangement was installed in conjunction with the shutdown system. The operation of this system proved very satisfactory and a similar arrangement has been designed by Natural Gas Pipeline for its main-line stations. All of the valves used in the blowdown system are opened by piston action and can only be closed manually. Automatic compressor-engine ignition shutoff is also a part of the system. Fuel gas to the compressor engines is carried at 30 psi. It must be shut off immediately to prevent detonation in the engines or exhaust system.

A fuel-gas shutoff device has been incorporated with the ignition shutdown to handle this situation. Although the high-pressure gas is vented, it is still necessary to have power available from our gas-driven generating units. An emergency source of fuel gas for the auxiliary engines is provided by a pipeline tap on the line side of the station block valves. This tap while assuring a permanent gas supply also serves as the discharge - pressure - gage connection. A pneumatic valve operator causes a valve in the fuel-gas meter run to open at the same time as the blowdowns are opened in order to maintain fuel-gas pressure to the auxiliary engines which, in turn, operate our fire-protection system.

At our two field stations where compression, dehydration, and gasoline-stripping facilities operate side by side, the shutdown requirements are somewhat different. A too rapid blowdown in our gasoline plants would cause fluid loss from the stripping units and tray upset at the dehydration towers. As before, the entire station is isolated by block valves with the gasoline and dehydration plant being isolated separately. A separate control-valve stand in the gasoline plant area can be manipulated to open the gasoline-plant blowdown valves with automatic valve operators. Also at our field stations the emergency fuel gas to the

Ethyl Research Performance of Today's

by T. W. Warren

Director, Refinery Technology, Ethyl Corporation Research Laboratories

A premium fuel being road tested in one of Ethyl's controlled-weather rooms that duplicates road conditions exactly.

Reports on Premium Fuels

NINETY-ONE premium gasolines and 12 third-grade super-premium fuels have been tested on the road and in the laboratory in a research program recently completed by Ethyl's Detroit Research Laboratories.

The results of this investigation have been published in a 140-page report entitled "Antiknock Behavior of Premium Motor Fuels, 1957", now available to all companies in the Oil and Automotive Industries.

The fuels tested were submitted by 83 refineries of 48 American companies. These refineries produce 75 per cent of the motor fuel in the United States. Seven Canadian companies, producing an appreciable percentage of Canada's gasoline needs, also submitted fuel samples for testing.

Each Gasoline Tested 32 Times

Five 1957 cars normally requiring premium fuels, and three cars equipped with experimental 11 to 1 compression-ratio engines were used in the tests. A minimum of two Modified Uniontown and two Modified Borderline ratings were obtained for each gasoline in each car, a total of at least 32 road ratings for each fuel sample.

Extensive laboratory data, including determinations of tetraethyllead susceptibility, hydrocarbon type, and bromine number, were also obtained and are included in the report.

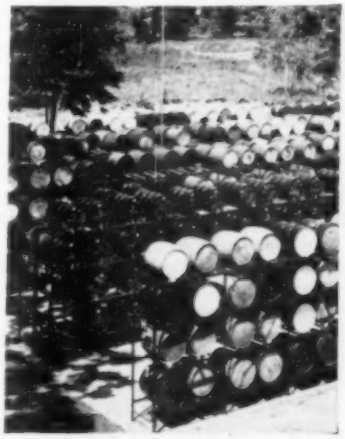
Test Results Point to Future Gasoline Developments

The broad sampling of premium fuels tested gave an accurate picture of today's premium gasolines and how they perform in the cars of today and in the higher compression engines of tomorrow. A complete analysis of all the test data led to the following conclusions affecting refining economics:

1. Sensitivity (the difference between Research and Motor octane number) often is an unreliable measure of road performance through the normal speed range.

2. Research and Motor octane numbers can be used to predict road performance at low speeds but are less reliable at intermediate and high speeds.

3. At higher speeds, road performance increases when the aromatic content of the gasoline is increased.



The 103 premium and super-premium gasolines in these drums were tested for Ethyl Corporation's 1957 premium fuel survey. This is the fifth premium survey conducted by Ethyl since 1946.

An important by-product of this program was the development of a system for calculating the road octane number of a gasoline. This development will permit individual refiners to determine the "road octane number" of their gasoline blends using the results of simple laboratory tests.

How Ethyl Research is helping you

Since World War II, Ethyl Corporation has investigated the laboratory and road performance of premium-grade gasolines in 1946, 1949, 1951 and 1954. During this period, the number of fuels analyzed has increased from 12 gasolines in 1946, to 63 in 1954 and 103 in 1957.

"Antiknock Behavior of Premium Motor Fuels, 1957" is one more example of Ethyl's continuing service to the Oil Industry. Copies can be obtained from your Ethyl Representative or by writing Ethyl Corporation, 100 Park Avenue, New York 17, N. Y.

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RESEARCH LABORATORIES:
1600 W. Eight Mile Road, Ferndale 20, Mich.
2600 Cajon Road, San Bernardino, Calif.

auxiliary engines is controlled by automatic valve operators.

While we have not had to call upon the new systems for emergency purposes, they have performed well when tested. This year will see this system of blowdowns installed at all locations.

Modified Closed Cooling-Water System

Water supply in the states where our pipeline operates is becoming critical. Once plentiful, water sources are dwindling rapidly. As a result we have had to revise our entire system of water cooling.

The original cooling facilities installed at the main-line compressor stations were atmospheric towers. These towers cooled the discharge gas as well as the engine piston and jacket cooling water. Experience taught us that the atmospheric towers were subject to algae growth which seriously reduced their efficiency. It was possible to remedy this situation although it required a great deal of maintenance expense. As developments in industrial cooling progress, the induced-draft cooling tower was considered and then adopted to replace the atmospheric towers. Efficiency was improved and algae growth eliminated.

In the 1930's and 1940's water for cooling was available in the amounts needed at all locations although the typical station daily consumption was 150,000 gal. The continuous use of this much water required the drilling of additional wells from time to time as older wells became exhausted or lost capacity due to falling water tables. By 1955, this situation had become acute at the stations in Iowa. In summer our daily requirements were barely met by the system of water wells we had drilled.

Advantages . . . An investigation of the recently developed closed water systems revealed several conditions that were particularly desirable. We found that we could reduce our consumption from 150,000 gal. per day to a maximum of 7,000 gal. per day. Inasmuch as the entire quantity of water required lime treating, our treating expense could be greatly reduced. Also, the sludge-disposal problem connected with lime treating was greatly modified.

The tremendous reduction in throughput would make zeolite treatment feasible, which would eliminate the sludge problem entirely. Corrosion could be greatly mitigated by a closed water system. The open systems as installed were the source of a great deal of corrosion due to the oxygen dissolved into the water during the cooling process. To eliminate the oxygen, we had constructed elevated gasification tanks where main engine fuel gas was bubbled into the water passing through the tanks to absorb oxygen.

In developing the closed system, it was decided to use air-cooled finned-tube heat exchangers where great quantities of air are forced across the tubes. Special structures had to be purchased for this purpose. The existing pumps were incorporated into the revised system and the piping utilized where possible. The gasification tower now serves as a surge tank. The water from the pumps is delivered to the coolers through a bypass arrangement that maintains the desired temperature, thence to the gasification tower which maintains the constant head on the water entering the engine jackets and pistons.

We are able to maintain water at a 150° inlet and 170° outlet temperature range at the engines under all atmospheric conditions and operating variations. Experimentation with this arrangement has indicated that an additional pump was required to increase slightly the water pressure to the pistons. Again, all of the modifications were accomplished with few changes and no additional major equipment items except, of course, the new coolers. These modifications have considerably improved our operating economy and efficiency.

Supercharging Compressor Engines

In 1929 Natural Gas Pipeline Co. constructed nine main-line compressor stations each having five 1,250-hp. horizontal engines. As market demands increased, additional engines were installed at various locations to provide additional capacity. All of these installations were made at considerable expense.

In 1951, it was determined that the horizontal engines were adaptable for supercharging. The first installation was made at our station at Hooker, Okla., where we were able to increase horsepower by 40 per cent to 1,750 hp. As supercharging was not feasible when the engine had been designed, the arrangement whereby that could be accomplished was somewhat complicated. We had to remove the entire exhaust line and muffler and replace it with individual 6-in. exhaust lines for each power piston. The lines are directly connected to the exhaust turbine.

The exhaust gases go from the turbine to the reused muffler nearby. The pulse-type turbine on the exhaust is coupled to the air intake turbine to increase air pressure to a maximum of 5 psig. Fuel gas to the power cylinder has been increased to 25 psig. While this pressure may seem high, the small amount of gas injected into each cylinder does not upset the air flowing into the pistons at the lower pressure. New cams are used to increase intake and exhaust valve overlap. The scavenging thus created improves combustion.

More horsepower for less money . . . Fuel-gas requirements for supercharged engines is on the order of 7.5 cu. ft. of 1,023-B.t.u. gas per horsepower-hour. Maximum fuel economy for regular units is about 9.5 cu. ft. per horsepower-hour. It soon developed that ambient air conditions altered combustion conditions in the cylinders because of variations in air density. It was necessary to install a pressure regulator operated by ambient air temperatures to keep the fuel and air mixtures constant.

Supercharging has not caused the exhaust temperatures to increase since the improved scavenging functions to keep the jacket-water cooling load approximately the same as it had been. New safety devices were required for the new equipment. The increased fuel pressure made it necessary to install automatic shutoff valves on the fuel lines to the engines which will close on ignition failure. In addition a turbine-oil failure alarm is necessary to make the operator aware of impending shutdowns due to turbine trouble.

This type of equipment has been operating at our Hooker station for 3 years. In 1956 one unit at each of two of our other main-line stations was supercharged with good results. We are now supercharging several main-line engines, which will greatly increase our available system horsepower.

No significant piping revisions due to the increased capacity are required since the original design of the manifold piping had been quite conservative. The compressor buildings will have to be widened to accommodate the new equipment. The resulting increase in system horsepower was achieved at a fraction of the cost that would be required for installing new compressor engines and their related equipment.

Exhaust Tuning of Auxiliary Engines

Each of the main-line stations is equipped with two 175-kw. and one 188-kw. generating units. The two 175-kw. units are driven by four-cylinder, four-cycle, 260-b.hp. prime movers. The supply provided by this equipment proved ample for the first years of operation. However, as time went on, more and more electrically operated equipment was being utilized at the stations. In addition, the in-

creased use of electrical appliances in the cottage areas stepped up the kilowatt loading. Several years ago as the power situation became acute the several means of increasing available electricity were investigated.

Any increase in generating facilities was not feasible in the existing building. The most promising prospect was a method by which we would increase the horsepower rating of the existing prime mover without having to alter the generator. Fortunately the generators originally purchased had been sized conservatively. They could produce additional kilowatts of electricity up to 275-kw. if the prime mover could be adapted to put out the extra horsepower. The cost of such an increased output was of course far less than the cost of entirely new facilities.

The initial conception called for an electrically driven blower to deliver air at 1½ to 2 psi. to an evaporative-type cooler without altering valve timing or using fuel-gas injection. Experimentation with the blower revealed that a different exhaust-valve timing was necessary, that is, exhaust-pressure pulses from the cylinders would have to be altered to achieve satisfactory operation.

Several variations of sizes and lengths of exhaust piping were tried before a satisfactory design was achieved. This design required 5-in. exhaust piping of suitable length to accomplish the harmonic effect called "tuned exhaust." Fuel-gas injection and individual air-control valves were used to improve performance. By this time it was decided to eliminate the electric blower inasmuch as the increase in horsepower was offset by the power needed to operate the blower.

Thus we rely on exhaust tuning alone to increase the horsepower output of the engine. Since the units run at a constant speed, exhaust tuning is feasible. In addition it was necessary to alter valve timing to amplify the effects of tuning. The units are now capable of operating at rated load of the generator, namely 275 kw., an increase of more than 50 per cent of usable capacity at a very low increase in cost. Updating the generators has allowed the company to continue other improvement programs without costly additions to generating equipment and structures.

Exposure of Manifold Piping

At the time of our original construction in 1929, it was considered good practice to install piping headers underground. The main-line stations were constructed in this fashion with the suction and discharge header installed below grade parallel to the compressor building. Individual 6-in. leads were installed to and from each compressor, a total of four lines per engine. The first modification was in the first years of operation when the starting bypass lines, and relief valves, were relocated to the manifold area outside of the compressor building.

As part of normal operating procedures the underground piping at the compressor stations was inspected periodically to keep a close check on the condition of the piping. Any indication of advanced corrosion called for immediate replacement of the corroded section. Every 5 years all underground piping in the manifold area was cleaned to bare metal and recoated.

Modifications . . . In 1949, at the time that one of our field stations was being expanded, the manifold-piping design was altered to the extent that the new discharge lines from the engines to the cooling towers were all installed above grade. The piping from the cooling tower went below grade as it had been previously. In addition, the long header sections were revised to reduce and control vibration and pulsation. However, in spite of stringent maintenance, the piping that had been in service for 20 years had deteriorated to the point of almost complete replacement.

In connection with this replacement, it was also decided to build "sunken gardens" which would expose all of our manifold piping installed on original construction and thus aid inspection, simplify repair and maintenance, and eliminate electrolytic corrosion. Another modification made at this time was to eliminate the vertical sickle bends that were installed on the discharge lines at the cooling tower. The Z-bends now installed are easier to hold down and consequently are not subject to vibration stresses which are a primary cause of piping fatigue failures.

The suction and discharge piping design, for piping installed under our expansion programs, was altered so that one 8-in. suction and one 8-in. discharge line were installed per engine. All of our main-line compressor stations have been equipped in this fashion. The ease of maintenance has been well received by our operating personnel. The simplification of the newer piping has helped improve operating conditions.

The effort of the several modernization programs has been to keep our installations current. We have been able to take advantage of technological advances to improve efficiency and operating economy. Naturally, other modifications of a minor nature are occurring constantly. Each of the changes described earlier represents a major alteration to the compressor station properties.

These alterations came into being only after detailed investigation and consideration during the planning stages. Future modifications to keep us in step with modern pipelining will be handled in like manner. **End.**

BOOKS

PETROLEUM PRODUCTION TECHNOLOGY. Published by Texas Engineering Experiment Station, College Station, Tex. 124 pp. $2.

This new publication contains 17 technical writings by prominent technologists in the oil-production field.

GUIDEBOOK TO THE GEOLOGY OF THE UINTA BASIN, eighth annual field conference, 1957, published by Intermountain Association of Petroleum Geologists, Box 34, Salt Lake City, Utah, 224 pp.

Recent development in the Uinta basin have added considerably to the storehouse of subsurface information. This new guidebook is designed to bring the geologist up-to-date on current activities. The economic importance of this large, relatively unexplored basin, is emphasized by the fact that oil and gas reserves of major size, such as the Red Wash field, are present.

The Uinta basin offers innumerable problems in stratigraphic, structural, and economic geology. Along the outcrops are vast reserves of hydrocarbons in both sandstones and oil shales, and it is only a question of time before it will be possible to extract these reserves.

The guidebook has many excellent papers covering the Uinta basin, both from a geological and an economic aspect. These papers are all well illustrated, and the guidebook contains a very fine geologic map of northeastern Utah.

CENTRIFUGAL AND AXIAL FLOW PUMPS, by A. J. Stepanoff. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 462 pp. $12.

This new edition is revised and expanded to include the considerable progress in the theoretical reasoning, design, and application of centrifugal pumps, which has appeared since publication of the first edition. The author treats of the following: Selected Topics from Hydraulics; Definitions and Terminology; Theory of the Centrifugal Pump Impeller; Vortex Theory of Euler's Head; Specific Speed and Design Constants; Design of Mixed Flow Impellers for Centrifugal Pumps; Pump Casing; Axial Flow Pumps; Hydraulic Performance of Centrifugal Pumps; Leakage, Disk Friction, and Mechanical Losses; Axial Thrust, Cavitation in Centrifugal Pumps; Special Operating Conditions of Centrifugal Pumps; Special Problems of Pump Design and Application; Shaft Design for Critical Speeds; Special Problems and Applications of Vertical Turbine and Axial Flow Pumps; Special Problems and Applications of Centrifugal Pumps; Centrifugal-Jet Pump Water Systems; Water-Hammer Problems in Centrifugal Pump Systems.

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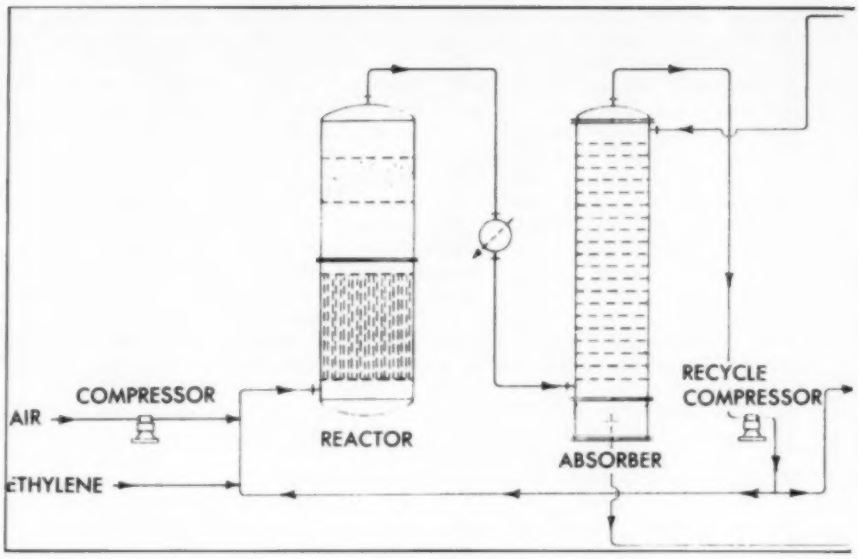


FLUIDIZED-BED process provides for continuous oxidation of ethylene to ethylene oxide. This process was developed by Vulcan Copper & Supply Co.

Twelve variables are important in selecting the operating conditions for making ethylene oxide by the direct-oxidation process. The effects of these variables have been quantitatively determined.

By

Peter W. Sherwood
Chemical Engineer

PART 2

Ethylene Oxide by the

THE EFFECT of these variables on performance will now be considered: (1) catalyst preparation, (2) use of inhibitors, (3) effect of temperature, (4) effect of contact time, (5) effect of pressure, (6) effect of impurities, (7) ratio of reactants, (8) conversion per pass, (9) recycle ratio, (10) inerts in feed gas—amount of purge gas, (11) afterprocessing of reactor gas, and (12) fluidized vs. fixed-bed operation.

Operating Conditions

1. Catalyst preparation . . . All commercial ethylene oxidation catalysts call for the use of silver in a form which will be reduced to metallic condition either preceding or during its onstream life. The catalyst is always supported on a carrier, generally promoted by a salt of an alkali metal or alkaline earth.

Work by McKim and Cambron[9] indicates that the activity of unpromoted silver catalysts, prepared by the precipitation of silver metal or its oxide, or by the thermal decomposition of an organic silver salt, is a function of particle size only and is independent of the method used for preparation.

The use of pure silver, with or without support, is made unfeasible by rapid loss of activity due to sintering at the required operating temperature. It is therefore common practice to incorporate a promoter which serves to enhance both the stability and activity of the catalyst.

The choice of **catalyst support** is critical. In general, silica gel is not suitable. Alumina is preferred in a relatively nonporous form (pumice, alundum) since supports with very large surface area per unit volume lead to excessive carbon dioxide and water formation. The point is also made in several preparations that the carrier should exhibit good thermal conductivity in order that local hot spots are minimized.

The **catalyst** developed by I. G. Farbenindustrie is prepared by precipitating silver oxide from a 10 per cent silver nitrate solution by means of a 10 per cent solution of potassium hydroxide which must be free of chloride or sulfide ions. The product is filtered and thoroughly washed. The wet filter cake is made into a paste and mixed with pumice particles of 6-mm. diameter, which have been washed with nitric acid and water. The mass is dried and reduced with dilute hydrogen at 150°-200° C.[10]

Promoters . . . Drummond of Vulcan Copper & Supply Co.[11] recommends the addition of small amounts of potassium chloride to a supported silver catalyst used in fluidized-bed service. For fixed-bed catalysts, however, investigators have generally shied away from chlorides.

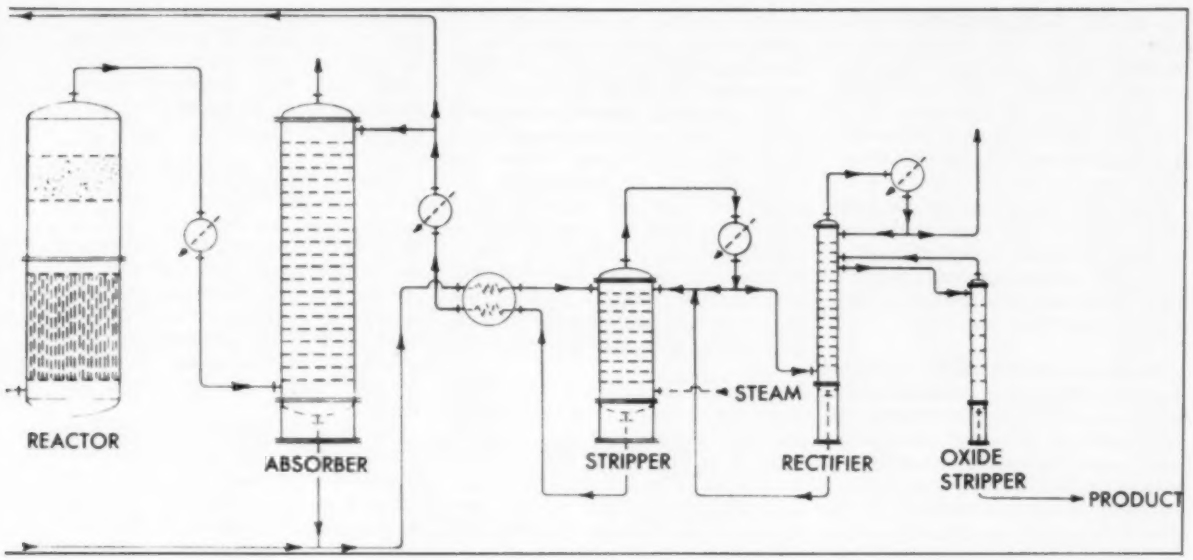
The weight of evidence favors the use of weakly basic salts of alkaline earth metals as promoters for silver catalyst. Strongly basic materials, such as calcium oxide, raise the level of activity but lower selectivity. McBee[14] and Wan[15] employed silver catalysts promoted by barium peroxide. McKim & Cambron[9] favor the use of calcium oxalate as promoter.

Scientific Design Co.'s Landau[12] claims particularly good selectivity and catalyst life for a supported silver catalyst promoted by calcium or barium lactate in the amount of 5-12 per cent weight, based on silver. He calls for an alumina carrier of medium porosity. Both he and Egbert[13] prefer a catalyst consisting of ceramically bonded fused alumina particles having a surface area of 0.025-0.057 sq. m. per gram. The support is provided in approximately ⅜-in. irregular particles. It is coated with a slurry of precipitated barium lactate, and is finally dried and roasted. The finished catalyst contains 7-15 per cent weight silver.

Various other methods of catalyst preparation have been described by the author elsewhere.[6,10]

2. Use of inhibitors . . . Addition of certain inhibitors to the reactor feed is effective in suppressing the complete combustion of ethylene, at least to some extent, without similar effect on the main reaction. The result is an improvement in selectivity, and a lesser tendency toward formation of local hot spots which are prime causes for high carbon dioxide and water formation.

Best known among such inhibitors are chlorinated hydrocarbons, but others—among them ozone and hydrogen peroxide — have also been claimed to be effective. All of these materials must be controlled to very low concentration. Ethylene dichloride, present in a concentration of 1



Direct Oxidation Process

p.p.m., leads to rapid catalyst poisoning. Such poisoning is temporary and catalyst activity can be restored by passing methane or ethylene through the catalyst bed for some time.

Nevertheless, it is objectionable because it interrupts continuity of production and decreases the life expectancy of the catalyst.

The low concentration, which is permissible in the converter, may be controlled by saturating a small side stream of feed gas in contact with liquid or solid inhibitor. The method is particularly accurate if the inhibitor has a low volatility. High vapor pressure is a definite drawback of ethylene dichloride in this service.

Chlorinated diphenyls . . . Particular interest attaches to the use of chlorinated diphenyls as inhibitors in the partial oxidation of ethylene. Concentration of this material, too, must be kept well below 1 p.p.m. in order to prevent catalyst deactivation. Because of its low volatility, the addition of this inhibitor may, however, be readily controlled within the permissible limits.

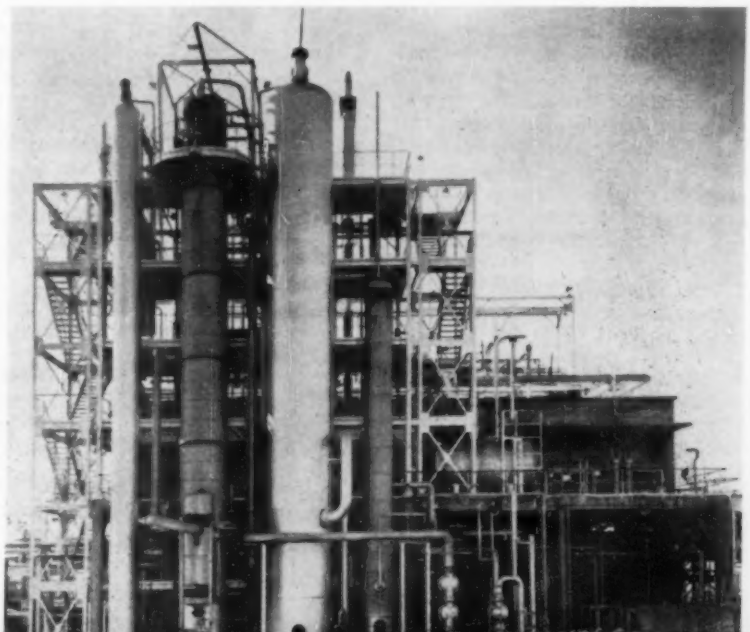
Beckham[16] reports one example in which the partial oxidation of ethylene was carried out over a catalyst consisting of porous aluminum silicate coated with silver oxide, promoted by a barium compound. Reactor feed contained 5 per cent ethylene, 6 per cent oxygen, and 89 per cent nitrogen. The catalyst was maintained at 250°-260° C. In the absence of an inhibitor, and with a per-pass conversion of 37 per cent, selectivity was 40 per cent.

When 0.3 p.p.m. chlorinated polyphenyl was introduced with the feed gas, conversion was 36 per cent (i.e., nearly the same) but ethylene oxide efficiency rose to 72 per cent. By the same token, catalyst hot-spot temperature dropped from 335° to 268° C. Long-term effect of this inhibitor is not reported by Beckham.

3. Effect of temperature . . . Two main reactions occur in the partial oxidation of ethylene: conversion to ethylene oxide, Equation 1, and complete combustion of ethylene to carbon dioxide and water, Equation 2. In addition there is evidence that ethylene oxide, once formed, is further oxidized to CO_2 and H_2O.

Of the three reactions, the desired formation of ethylene oxide has the highest rate at low temperatures, but it also has the lowest temperature coefficient. Accordingly, the rate of all three reactions increases with temperature, but the selectivity for ethylene oxide declines. Thus Orzechowski[17] reports an initial selectivity of 60-64 per cent at 234° C. and of 50-52 per

THIS FIXED-BED PLANT for making ethylene oxide employs the Scientific Design Co. method.



cent at 274° C. He concludes that the ratio of initial CO_2 formation to ethylene oxide formation increases from 0.60 at 234° C. to 0.95 at 274° C. Similarly, McKim[9] reports a decline in selectivity on pure silver catalyst from 58 per cent at 280° C. to 50 per cent at 320° C.

From these considerations, we may expect that the single-pass conversion to ethylene oxide passes through a maximum value as the temperature is raised, and this conclusion is borne out by actual observation.

Ultimate yield vs. selectivity . . . From the point of view of ultimate yield, operation at the lowest practicable temperature is desirable. The lower limit is set by uneconomically long contact time requirements, and its actual value is largely a function of catalyst activity. The factors of yield vs. throughput must be weighed by economic evaluation. It is for this reason that resort is had to promoters which will raise the activity of silver catalyst, though they have frequently adverse effect on the selectivity.

In some of the known ethylene oxidation processes, reaction temperature is in the range 240°-290° C. The actual level depends on the catalyst formulation, age of catalyst, desired conversion, and contact time.

4. Effect of contact time . . . An increase in contact time will raise conversion and will lower selectivity. For a given spread in conversion, the effect of contact time on selectivity is, however, less pronounced than is that of operating temperature (below 1 second, selectivity is almost unaffected by residence time). Considerations of ultimate yield alone lead therefore once again to preferred operation at the lowest feasible temperature and to compensation for low reaction rate by longer contact time.

Opposing this is the need for maximum throughput when the installation is pressed for production. At such times, the need to meet demand may well become the overriding consideration, and operating temperature is raised in order that holdup in the reactor may be shortened—even though this will decrease the over-all yield on ethylene.

With presently known catalysts, contact time in commercial reactors is in the range of 1.3 to 4.0 seconds.

5. Effect of pressure . . . The rate of ethylene oxidation is not significantly affected by pressure. Operation at elevated pressure is desirable, nevertheless, firstly because it reduces the size of equipment needed for a given contact time and secondly because the reaction product is dilute in ethylene oxide so that pressure is required in the water scrubbers if adequate product recovery is to be obtained.

For practical reasons, commercial processes are limited to operation not exceeding 150-200 psig. Above this level, the cost of compression becomes too high and requirements of pressure construction raise equipment cost excessively. Furthermore, a deleterious effect on catalyst life has been noted at high pressures, probably due to the more rapid occurrence of catalyst-fouling polymerization reactions.

6. Effect of impurities . . . Various impurities are harmful to the ethylene oxidation process and their near-absence from the reactor feed gas must be insured. The following table lists the chief contaminants in this category, and the main reasons why their presence is objectionable:

Impurity—	Objection
Sulfur, diolefins	Damage to catalyst.
Acetylene	Damage to catalyst explosive hazard; acetylene content must not exceed 10 p.p.m. of the ethylene feed.
Hydrogen	Explosive hazard, heat evolution.
Methane, ethane	Heat evolution, decreased reaction rate.

The gas mixture feed to the reaction system is normally saturated with respect to water. Such a small amount of moisture is not harmful, and one installation has been known to introduce enough steam to raise the moisture content to 1-2 per cent on the strength of some evidence that this tended to prevent runaway reactions. Very high steam content is, however, objectionable as it will convert product ethylene oxide to ethylene glycol in the vapor phase.

All commercial ethylene oxide processes recycle a portion of the reactor gases after contained ethylene oxide has been removed. CO_2 formed in the reactor due to complete combustion will build up in this recycle gas to a range of about 8-10 per cent. There is no evidence that this amount of carbon dioxide has an adverse effect on the reaction.

7. Ratio of reactants . . . On the basis of kinetic investigations, Twigg, and later Egbert[18] have developed an equation relating initial selectivity to the partial pressure of ethylene and of oxygen:

$$S = \frac{1}{1 + A\,(pO_2/pC_2H_4)^{1/2}} \qquad (3)$$

"A" is a coefficient which depends primarily on the catalyst and temperature of the system. In an example cited by Pellegrin, this coefficient is 0.162.

It is seen that total pressure has no effect on the initial selectivity and that it takes a very large change in the concentration of either reactant to make itself felt at this stage. Other investigators have confirmed experimentally that initial selectivity is quite insensitive to ethylene or oxygen concentration.

There is evidence that this small effect of oxygen: ethylene ratio on selectivity continues throughout most of the reaction period. But, increasing the reactants ratio very definitely increases the conversion per pass. An asymptotic maximum conversion is reached at an oxygen : ethylene ratio of 1.5-2.0, and this is also the range normally chosen for commercial operation.

The need to operate outside the explosive range restricts ethylene content to 3-5 per cent, oxygen content below 8 per cent. Typically, feed gas to the reactors contains 3-5 per cent ethylene, 5-7 per cent oxygen, 8-10 per cent carbon dioxide. The remainder is nitrogen.

8. Per-pass conversion . . . This is a dependent variable, controlled chiefly by adjustment of temperature and, to a lesser extent, by contact time.

The conversion taken per pass has profound influence on ethylene utilization. As conversion is raised, the amount of ethylene in the effluent gas declines. At the same time, the selectivity for ethylene oxide formation decreases. In over-all result, the ultimate yield on ethylene passes through a maximum value.

Just where this optimum yield level occurs, with a given catalyst, depends on two factors: amount of purge gas, and method of afterprocessing reactor gas. These two aspects will be considered individually here. Normal conversion per pass is between 25 and 50 per cent in the primary reaction stage. The lower conversion levels are employed when the amount of purge gas is small, as is the case when concentrated oxygen is used as one of the feed gases.

In air oxidation, two to three reaction stages may be taken in order to exploit the ethylene content leaving the primary converter. To obtain optimum yield, conversion in the different reaction stages is interdependent. In the I. G. Farben process the conversion taken in each of the two reactors, which are provided in series,

is about 50 per cent of entering ethylene.

In the process of Scientific Design Co., the primary reactor is operated at 30-40 per cent conversion. The cleanup reactor is run at much more drastic conditions to achieve a conversion of 75-85 per cent of the ethylene fed to it.

Several investigators have found that selectivity can be improved by arranging the catalyst in layers of increasing activity along the path of gas flow. Schultze and Theile[20] have chosen this course to obtain ethylene oxide yield as high as 69 per cent of theory. Egbert[13] was able to boost ethylene oxide content of make gas from 1.17 to 1.40 per cent by arranging the catalyst bed in layers of increasing activity, while keeping other conditions unchanged.

9. Recycle ratio . . . We have seen above that only partial conversion per pass may be taken. The effluent gas is freed of ethylene oxide. The washed gas still contains 50-70 per cent of the ethylene fed to the system. The bulk of this gas is therefore universally recycled to the reactor in order to permit further conversion of contained ethylene. The limit to the extent of recycle is set by costs incurred due to large equipment requirements and by power for gas circulation. For systems operating with small amount of inerts in the feed gas, a higher recycle ratio is feasible than for units employing air as oxidizing medium.

10. Inerts in feed gas — amount of purge gas . . . For reasons of operating safety, it is necessary to have a large concentration (approximately 80 per cent) of inert gas in the reactor. Universally, that gas is nitrogen.

There are three gas streams entering the converter system. These are the two feed streams—ethylene, and air or oxygen—and recycle gas. At steady state, it is necessary to purge from the system the inerts which are introduced with the feed streams. This purge stream will carry between 0.5 and 3.5 per cent ethylene with it (the amount depends on the concentration at reactor entry and the degree of conversion).

It is evident that one way to reduce the ethylene lost with this stream is to decrease the volume of inerts entering—and leaving—the system. This is the approach chosen for the Shell ethylene oxide process, in which not air but 95 per cent oxygen serves as oxidizing agent. Assuming that the ethylene feed contains 2 per cent inerts, the bleedstream obtained with 95 per cent oxygen is only about 2 per cent of that obtained with air as oxidizing medium. In over-all effect, ethylene conversion can be made almost complete by recycling, and yield on ethylene will be substantially equal to selectivity when purified oxygen is used.

This benefit is achieved at a price, namely the investment and operating costs for purification of oxygen. Lummus Co. estimates a cost of $5.8 million for a 37½ million pounds per year ethylene oxide plant, using the Shell process. Of this total investment, $1.25 million is accounted for by the oxygen production facilities (1953 costs).

11. After-processing of reactor gas . . . When air is the oxidizing medium, the purge stream is substantial. Furthermore, we have previously seen that only low conversion per pass may be taken. A significant amount of ethylene (say, 10-12 per cent of feed) will therefore leave the primary reactor system in the purge gas, even if maximum practicable recycle is taken.

Much of the ethylene value in the tail gas can be recovered by passing the primary purge gas through a secondary reactor.

In the I. G. Farben process, air is fed to the reaction system in large excess. Two reactors are employed in series. Ethylene enters the first reactor in 3 per cent concentration and is replenished to this strength preceding the second converter. Recycle is taken from the secondary converter exit to the primary converter entrance.

In the process of Scientific Design Co., a more concentrated ethylene (5-6 per cent) enters the primary reactor. Low conversion is taken per pass. The primary make gas is freed of ethylene oxide by water scrubbing and is recycled to the primary reactor entrance. A purge stream is joined by makeup air and the resulting mixture is taken to a secondary converter, where residual ethylene is converted at much more drastic conditions. Thus, the primary reactor is operated at low conversion for high selectivity. The purge reactor is run to high conversion for maximum single-pass yield.

The system is illustrated by Egbert.[19] In his example, a primary reactor is operated at 30 per cent conversion and 70 per cent selectivity. The purge gas contains 3.5 per cent ethylene, 4.1 per cent oxygen. By the addition of air, its oxygent content is boosted to 6.0 per cent. The stream is then taken to a secondary reactor where conversion is 76 per cent, corresponding to a 55 per cent selectivity. In this two-stage system, the following materials balance applies to ethylene:

	Moles ethylene
To make ethylene oxide	1.203
To make CO_2 in primary reactor	0.450
To make CO_2 in secondary reactor	0.125
Lost in final purge	0.085
Total	1.863

Over-all efficiency of this system is 64.5 per cent. Without a purge reactor, efficiency would have been only 56 per cent.

12. Fluidized vs. fixed-bed operation. All existing industrial installations employ fixed-bed converters. Advantage may also be taken of the excellent suitability of fluidized-bed reactors for effective heat transfer, and a process involving this feature has been developed by Atlantic Refining Co. in collaboration with Vulcan Copper & Supply Co.

The advantages of fixed-bed units in ethylene oxide service include: Less catalyst loss, wider possible range of throughput, less tendency to yield loss due to back mixing.

Against this, the proponents of fluidized-bed catalysis stress the latter system's lower investment cost and the larger latitude it permits in catalyst formulation because hot spots are absent in fluidized-bed systems and a question of catalyst crushing strength does not arise, as it does in fixed-bed converters.

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(Part 1 of this article appeared in the September 30, 1957, issue.)

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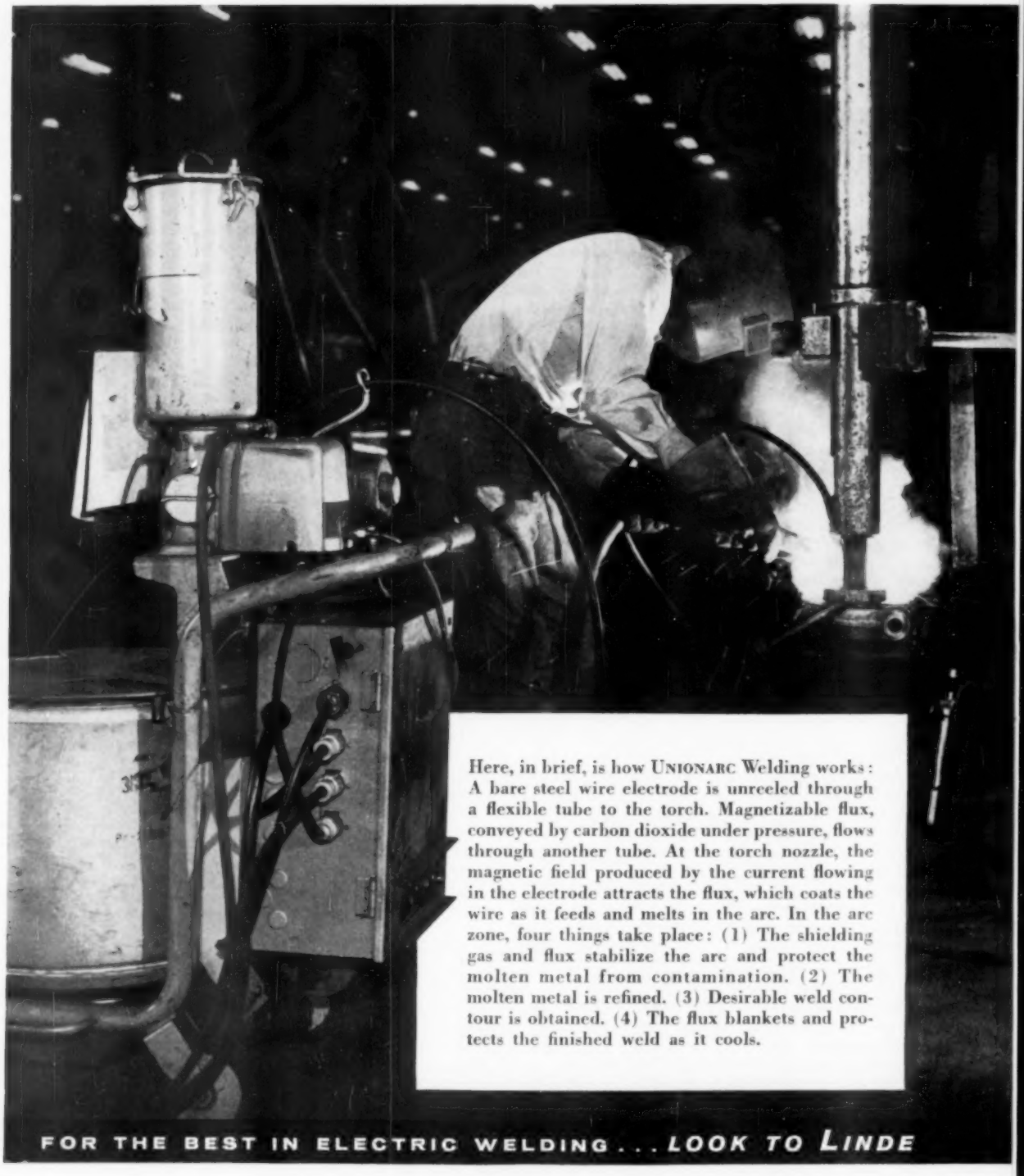

Here, in brief, is how UNIONARC Welding works: A bare steel wire electrode is unreeled through a flexible tube to the torch. Magnetizable flux, conveyed by carbon dioxide under pressure, flows through another tube. At the torch nozzle, the magnetic field produced by the current flowing in the electrode attracts the flux, which coats the wire as it feeds and melts in the arc. In the arc zone, four things take place: (1) The shielding gas and flux stabilize the arc and protect the molten metal from contamination. (2) The molten metal is refined. (3) Desirable weld contour is obtained. (4) The flux blankets and protects the finished weld as it cools.

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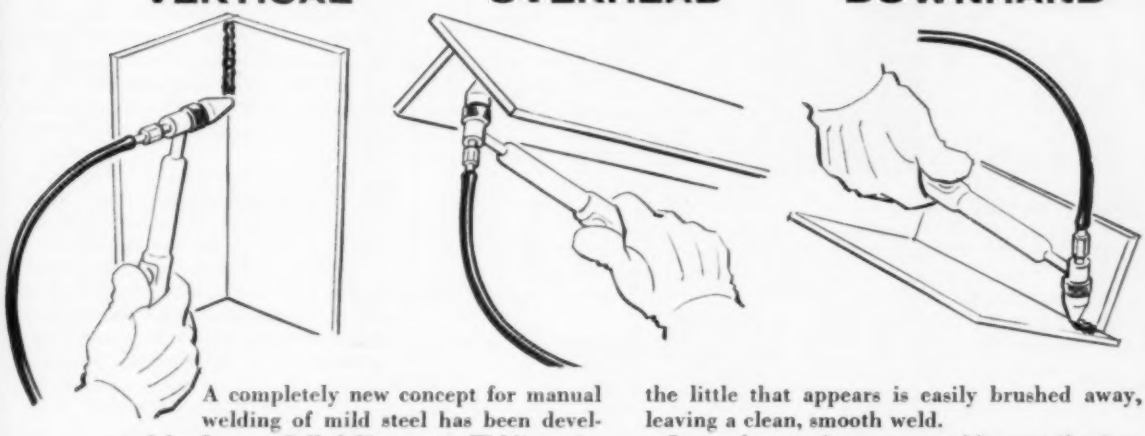

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Among the numerous advantages of UNIONARC Welding are these: Rate of operation is up to three times faster than with covered electrodes. There is no stopping to renew electrodes, since a single loading of wire can be fed smoothly and continuously for periods up to a week. Manual skill needed is no more than that required with covered electrodes. In vertical and overhead positions, the deposition rate in UNIONARC Welding is two to three times greater than with covered electrode methods; in downhand positions, up to twice as great. There is practically no spatter—the little that appears is easily brushed away, leaving a clean, smooth weld.

LINDE has made many notable contributions to welding. Among these are the introduction and development of submerged arc welding (UNIONMELT Welding), non-consumable electrode, inert gas shielded arc welding (HELIARC Welding), and the development of Sigma (shielded inert gas metal arc) welding. LINDE's newest method, UNIONARC Welding, is another *first*—a truly important contribution. Its simplicity and versatility make it unique. Its efficiency and economy have been proved in actual production work. Write *now* for details about UNIONARC Welding, or call the LINDE office nearest you.

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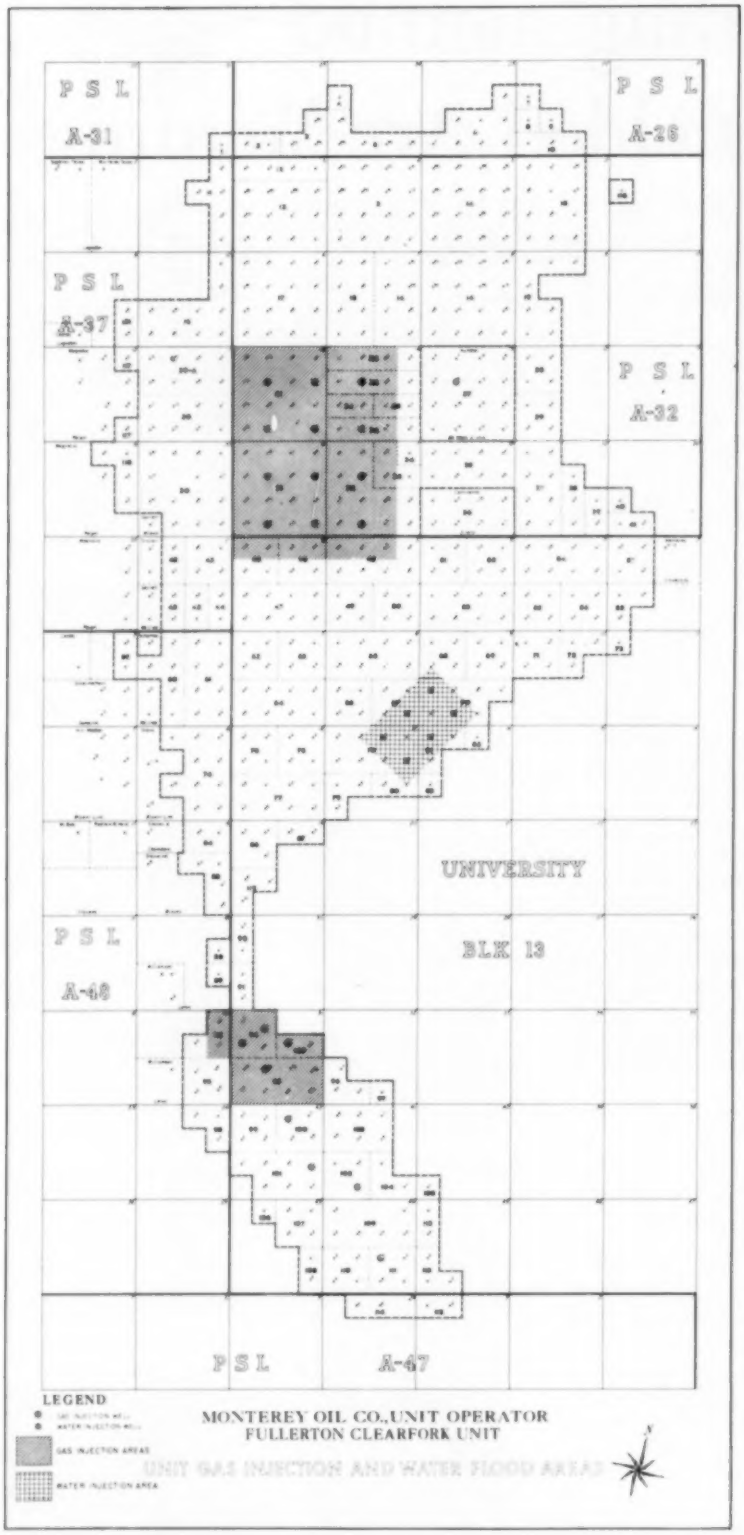


CLEARFORK UNIT is returning produced gas to producing formation to boost primary recovery by 4 per cent of oil in place. Water-flood tests also are promising. Fig. 1.

Fullerton field shows . . .

How Fractured

FULLERTON field is located in northwestern Andrews County, Texas, and produces primarily from the lower Clearfork zone, an early Permian dolomite formation. The anticlinal structure has closure on two domes with the major axis of the structure extending in a general north-south direction.

Commercial extent of the reservoir is determined by porosity pinchouts which do not follow the structural contours. Developed area of the north dome covers 21,400 acres and is drilled on 40-acre spacing. The south dome has a developed area of 3,700 acres and is also drilled on 40-acre spacing.

The Clearfork zone is at a depth of 6,700 ft. and ranges in gross thickness from 500 ft. in the center of the dome to 250 ft. on the flanks.

Water production from the reservoir has been less than 1 per cent of the fluids produced. The field is under solution-gas drive with no detectable flank or bottom water movement.

The field had an original static bottom-hole pressure (b.h.p.) of 2,980 psi., and the crude-oil bubble point was 2,370 psi. with 1,160 cu. ft. of gas per bbl. being in solution. Early in the producing life of the field it was obvious the solution-gas drive would be relatively inefficient. Operators began to study the various means of unitizing and entering into a secondary-recovery program.

Gas-Injection Operations

Monterey Oil Co. became unit operator in February 1954, when 24,040 surface acres of the field were unitized for secondary-recovery operations. Four months after unitization, 16 wells were converted to gas injection (Fig. 1). Gas injection began with a volume of approximately 21 M.M.c.f.d. or 30 per cent of the total gas production being returned to the reservoir. In September 1956, four additional wells were converted to gas injection, and the injection volume was increased to 25 M.M.c.f.d.

Boosts allowables . . . Fullerton field operates under a limiting 2,000 cu. ft. per bbl. gas-oil ratio. Gas returned to the reservoir removes production penalties to the maximum of 66 bbl. of oil per producing day per well.

The cumulative volume of gas injected into the 20 gas-injection wells

Part 1

Limestone Responds to Gas Injection

Return of produced gas boosts primary recovery. Oil is moved large distances with little gas bypassing.

By W. E. Nolan and G. R. Locker

in the Fullerton Clearfork unit to January 1, 1957, was 17.8 billion cubic feet. A total of 3 million barrels of oil has been produced from the unit in excess of the normal allowable production as a result of the penalty removal feature of the gas-injection program.

In July 1954, when gas injection in the north dome began, static bottom-hole pressure in the injection area had declined to an average of 1,269 psi. A pronounced pressure gradient existed across the injection area as shown on Fig. 2. Static bottom-hole pressure varied from 1,700 psi. in the northeast to 700 psi. in the southwest.

Based on average pressure and gas-oil-ratio performance, the initial gas saturation was calculated to be 18 per cent of pore space. In the south dome, the average pressure when injection operations began was approximately 1,634 psi. with a corresponding gas saturation of approximately 15 per cent of pore space.

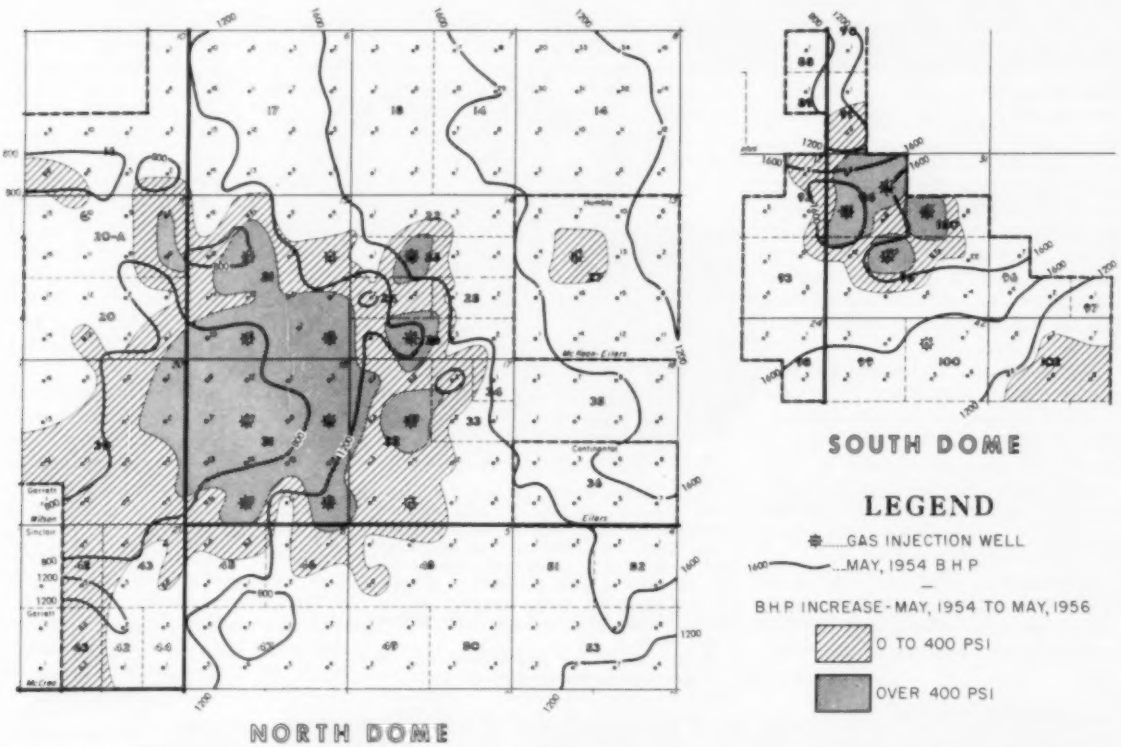
Since the north dome project covered a greater portion of the reservoir, had a higher initial gas saturation, and similar reservoir characteristics, primarily north dome performance will be discussed.

Point of injection . . . In the north dome, injected gas was restricted to the lower Clearfork producing zone.

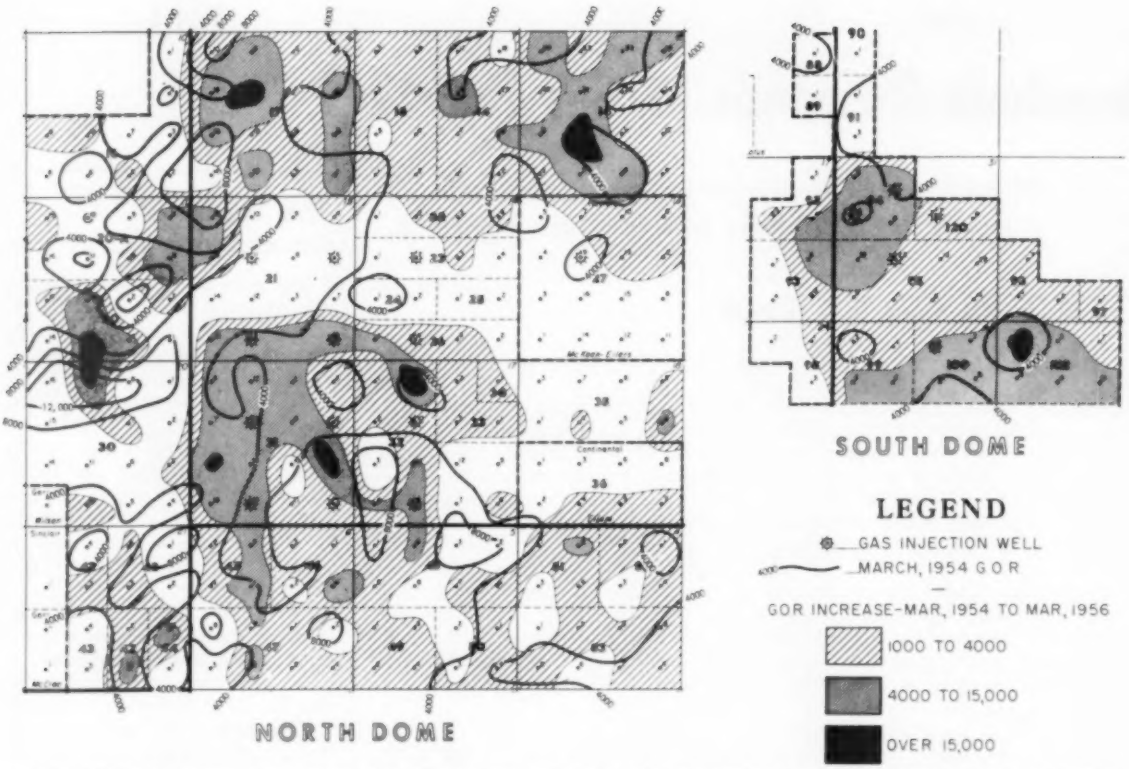
The Authors' Conclusions . . .

Fullerton field demonstrates that the Clearfork dolomitic limestone will respond to both gas injection and water flooding to improve oil recovery. This part of the article describes results of gas injection. Conclusions are:

- An additional 4 per cent of reservoir oil in place can be recovered by return of 80 per cent of produced gas to the reservoir.
- Operating expenses will be reduced because wells will flow longer.
- Current income is increased because allowable penalties due to high gas-oil ratios are reduced.
- Gas injection is feasible for the fractured and vugular porosity of this type of dolomitic reservoir. Oil can be moved considerable distances with a minimum of gas bypassing.



PRESSURE INCREASE around the gas injection wells shows uniform gas advance. Most of gas is injected into area that had low pressure. Fig. 2.



GAS-OIL RATIO has increased over much of the injection area but despite this oil-producing rates have climbed as much as fivefold. Fig. 3.

A typical radioactivity log in the injection area in the unit shows that four Clearfork zones are penetrated. The first and second zones are referred to as the upper reservoir, and the third and fourth zones are referred to as lower reservoir.

All gas injected has been below formation packers in the barrier zone between the upper and lower reservoirs. To better evaluate progress of the injection program, six producing wells located diagonally between injection wells were also restricted in production to the lower Clearfork with formation packers.

Wide variation of porosity and permeability development exists. A considerable portion of the zone contains fine to medium intercrystalline porosity with an associated system of fractures. Vugular porosity associated with medium to coarse intercrystalline porosity is present also, particularly in the lower reservoir.

Radioactivity logs were run in all injection wells and a number of producing wells to select packer points and determine porosity of the reservoir.

Injection-Well Performance

In the north dome, injected gas volumes were gradually increased from approximately 90 to 1,400 M.c.f. per day per well. The injection wellhead pressures increased correspondingly from 1,450 to 1,950 psi. Wellhead pressure increases resulted from increased volumes as well as increasing static reservoir pressure.

No difficulty was experienced in converting the producing wells to injection and restricting the injected gas to the lower Clearfork zone with the use of formation packers. Rate of flow controllers were installed on all injection wells to maintain desired injection volumes.

Repeated back-flow tests have been made on injection wells in an effort to determine injection-well gas saturation. The wells have been produced at rates of 5 to 6 M.M.c.f.d. for periods of 5 to 7 days with no measurable oil being produced. It is apparent from this that the formation gas saturation from the portion of the zone being produced must be over 50 per cent of pore space.

Due to the high productivity of the injection wells, the producing bottom-hole pressure is consistently higher than the static bottom-hole pressure which existed at the time injection operations began. It is therefore not probable that oil can be produced from the nonconformed section until such time as injection is terminated and reservoir pressures are reduced to their preinjection level. These tests indicate a high degree of gas sweeping in the section through which gas movement is taking place.

Producing-Well Performance

Pressure performances of the gas-injection areas are shown in Fig. 2.

THE AUTHORS

W. E. NOLAN

G. R. LOCKER

W. E. Nolan is unit engineer for Monterey Oil Co., Hobbs, N. M., for the Fullerton Clearfork unit. Nolan was graduated from the University of Kentucky and worked as a production engineer for 10 year prior to joining Monterey in 1954. He was formerly district engineer of the West Edmond Hunton Lime Unit at Edmond, Okla.

George R. Locker joined Monterey Oil Co. as a petroleum engineer in 1955. He holds B.S. and M.S. degrees in petroleum engineering from the University of Tulsa. He is now with Fittings & Jones, consulting engineers and geologists, Midland, Tex. Paper was presented at the A.I.M.E. Permian Basin Conference.

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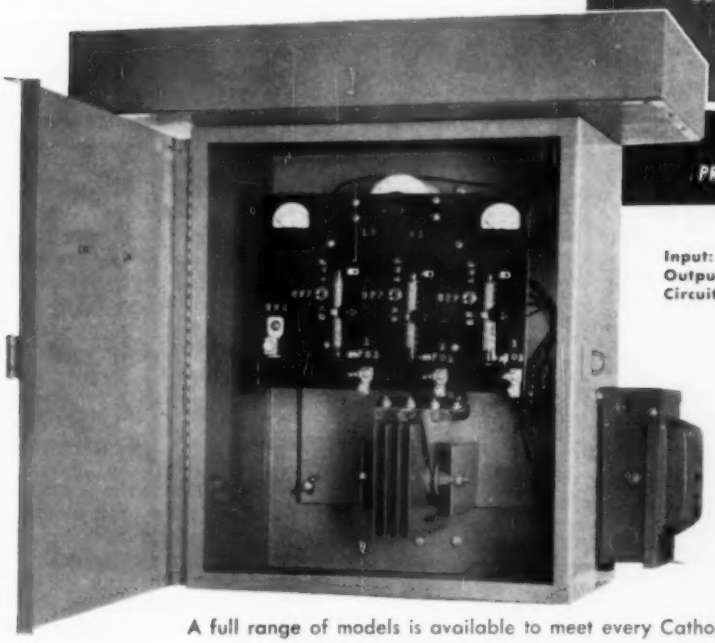

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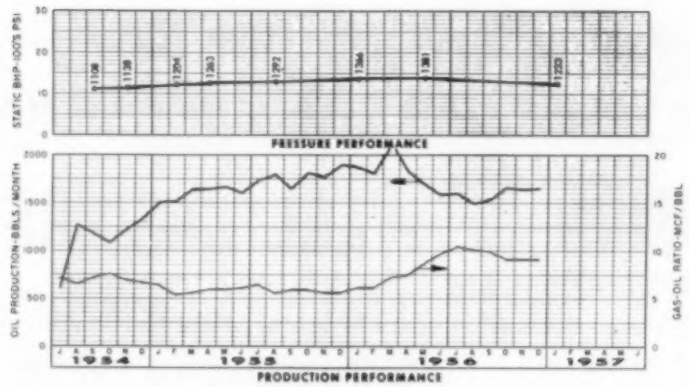
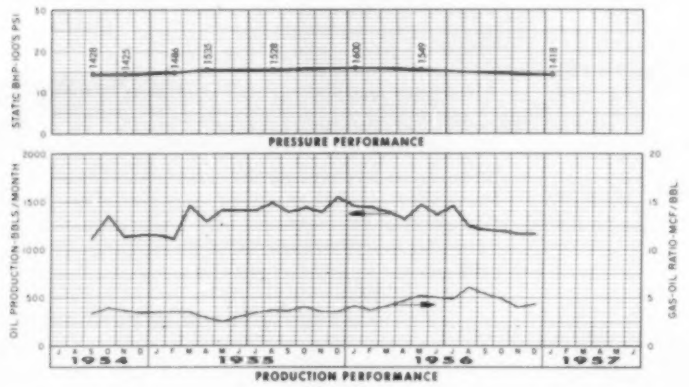


Chart 1



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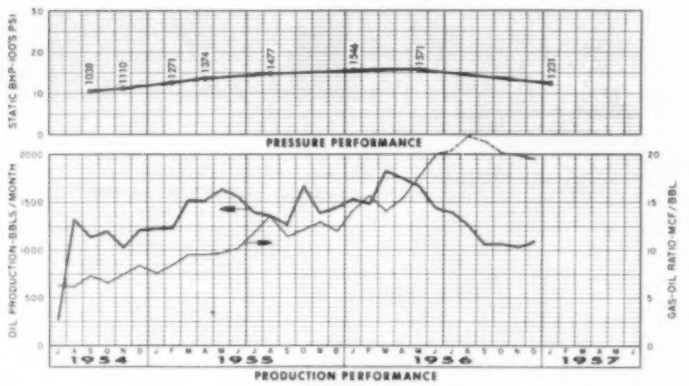

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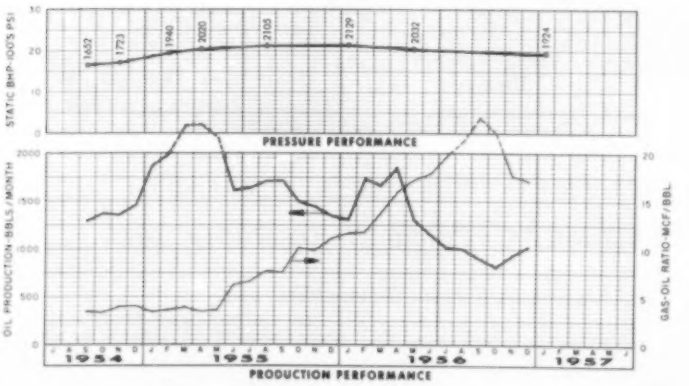


Chart 4

AVERAGE well performance of wells affected by gas injection. Top two charts are for improved wells; bottom two are for wells showing gas-saturation increase. First chart is average for 19 wells, north dome; second is for 5 wells, south dome; third is for 15 wells, north dome; fourth is for 2 wells, south dome. Fig. 4.

Note that the greater pressure build-up occurred in the area of relatively low initial pressure. A number of producing wells exhibited increases in static pressure in the order of 800 to 1,000 psi. and producing potentials were correspondingly increased.

When the gas-injection program was initiated, wells in the southwest portion of the north dome area had a maximum producing capacity of 30 to 40 bbl. of oil per day, with gas-oil ratios of 6,000 to 8,000 cu. ft. per bbl. Producing potentials were gradually increased as the area was repressured, and many wells in the area will now produce considerably in excess of 200 bbl. of oil per day, even though gas-oil ratios have increased to as much as 12,000 to 15,000 cu. ft. per bbl. Fig. 3 shows the gas-oil ratio at initial gas-injection conditions as well as the increase in gas-oil ratio to March 1956.

Producing wells in each gas-injection area have been classified in two groups, improved wells and gas-saturation-increase wells, and average well performance has been plotted in Fig. 4.

Note that the first group (Charts 1 and 2), which represent the average of 19 producing wells in the north dome, produced at an average gas-oil ratio of 6,500 cu. ft. per bbl. with an average reservoir pressure of 1,108 psi. when the gas injection program was initiated. The gas-oil ratio declined slightly for approximately 18 months of operation to 5,000 cu. ft. per bbl. and then gradually increased to a peak of 10,000 cu. ft. per bbl. The wells classified as having gas-saturation increases gradually increased from a ratio of 6,500 cu. ft. per bbl. at 1,038 psi. to 22,000 cu. ft. per bbl. at approximately 1,580 psi.

Volumes of Fluid

During the 30-month period of injection operations in the north dome, 14,031,761 M.c.f. of gas has been injected. At the average reservoir pressure of 1,230 psi. and assuming all gas to be in a free state, this represents a reservoir pore volume of 25,600,000

bbl. or approximately 19 per cent of pore space in the affected area.

Total oil production during the period from the same area was 1,147,813 bbl. with cumulative gas volume produced being 14,337,259 M.c.f. When corrections are made for solution gas and formation volume factor, it is calculated that the gross reservoir injection volume has exceeded the produced volume by 860,000 bbl. of pore space. This accounts for the pressure increase in the area. Note that the calculated injection volume based on gas being in a free state only slightly exceeds the volume voided by fluid withdrawals, yet pressure increases averaging 150 psi. occurred in the area. This factor indicates that no appreciable volume of injected gas is being returned to solution. Equilibrium calculations also bear out this supposition.

Effect of saturation . . . Oil and gas permeability-saturation trends were calculated from primary-performance material balance. These data were then crossplotted, as shown in Fig. 5, to establish the relationship between producing gas-oil ratio and well-bore gas saturation in per cent of pore space for various static pressures.

Referring to Fig. 4 and Fig. 5, note that the improved-well performance showed a calculated initial gas saturation of 18.5 per cent of pore space which decreased to 17.0 per cent of pore space in January 1956, and subsequently increased to 19.5 per cent of pore space at the present. The calculated increase in gas saturation is 1 per cent of pore space for the 30-month period of injection. Table 1 shows the calculated formation gas saturation as the gas-injection program progressed for the north dome producing wells:

TABLE 1—FORMATION GAS SATURATION

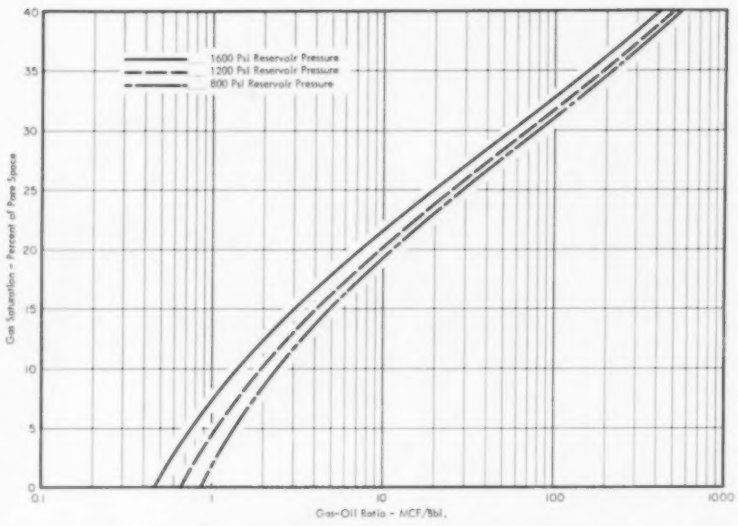
Improved Wells

Date—	G.O.R., c.f./bbl.	B.h.p., psi.	Per cent pore space*
July 1954	7,100	1,100	18.5
January 1955	6,500	1,180	17.8
July 1955	6,300	1,280	17.3
January 1956	6,100	1,366	17.0
July 1956	10,400	1,340	19.9
January 1957	9,100	1,233	19.5

Gas-Saturation-Increase Wells

July 1954	6,300	1,000	18.2
January 1955	7,600	1,220	18.5
July 1955	12,500	1,450	20.7
January 1956	14,300	1,546	21.3
July 1956	20,800	1,500	23.2
January 1957	19,500	1,231	23.4

*Apparent gas saturation from Fig. 5.



PERMEABILITY RATIOS calculated from primary performance are the basis of this relationship of gas-oil ratio to gas saturation. Fig. 5.

Voidage . . . The oil withdrawal from the 19 improved wells totaled 899,234 bbl. which when corrected for formation volume factor averages 1,685 bbl. of reservoir pore space per acre. Calculated total pore space averages 52,800 bbl. per acre so that the calculated reservoir voidage is 3.2 per cent of pore space. Note that the actual oil withdrawal in terms of pore space during the injection period is approximately three times the calculated gas-saturation change.

For the 15 wells showing gas-saturation increases, the initial gas saturation was 18.2 per cent which gradually increased to 23.4 per cent at the present time, representing 5.2 per cent increase in gas saturation.

Oil withdrawal from this group of wells was 599,694 bbl. or 1,400 bbl. of pore space per acre corrected to reservoir conditions.

This represents 2.67 per cent of the 52,800 bbl. per acre of pore space existing in the area. For this group of wells the calculated gas-saturation increase exceeded the pore volume withdrawal of liquids by some 50 per cent.

Total cycled gas volume is calculated to be 31 per cent of injected gas. For this estimate it is assumed that after a static pressure increase occurred at the well bore no further solution gas was evolved, and any increase in produced gas-oil ratio was classified as cycled injection gas.

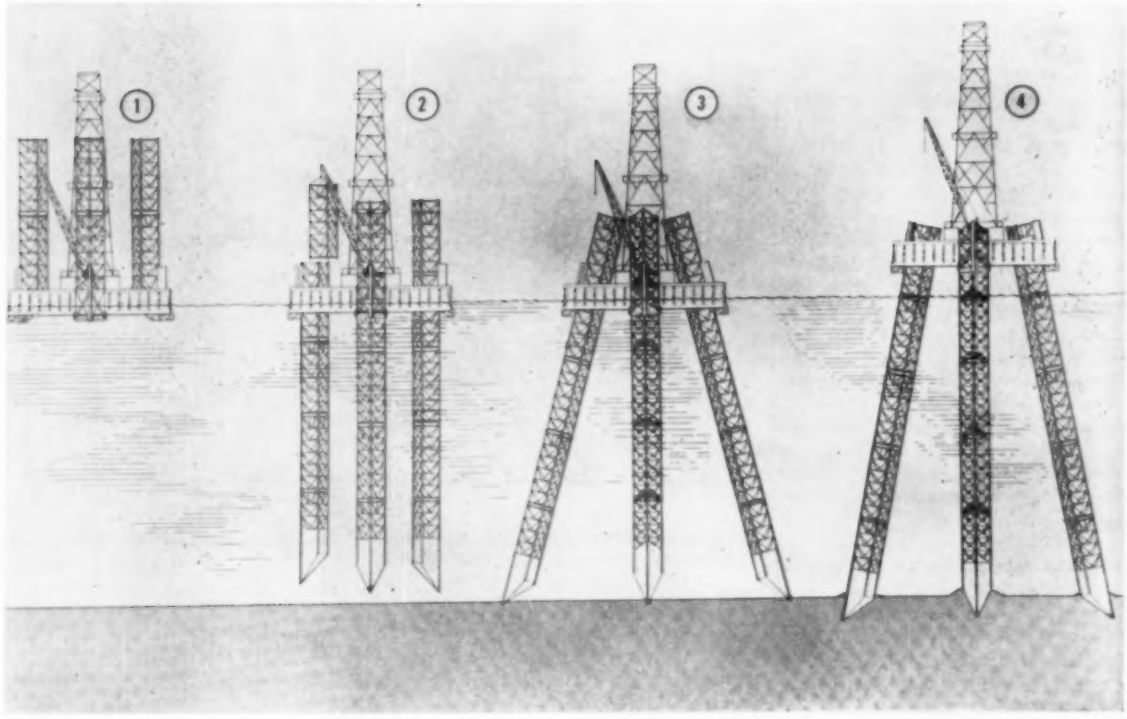
Conclusions

With the assumption of a 50 per cent conformance factor and K_g/K_o relationship existing in Fullerton field, it can be calculated that an additional 4 per cent of reservoir oil-in-place can be expected over primary recovery assuming that 80 per cent of the gas is returned to the reservoir. An ultimate oil recovery increase of 4 per cent would yield an additional 1,000 bbl. of oil per acre in the section of the Clearfork into which gas is being injected.

Some reduction in operating expense per barrel of oil produced will be realized due to longer flowing life expected of wells in the area. The third feature which makes this type program attractive is the current income gained as a result of reducing gas-oil-ratio penalties and providing sufficient productivity to maintain the allowable production.

It is apparent from the performance of the gas-injection program that the fractured and vugular porosity was not interconnected from well to well in such a manner as to preclude successful gas injection. Performance of this program gives further evidence that classifying carbonate rocks in general as being inherently unsuitable to disperse gas drive has no basis in fact.

Gas injection in Fullerton field has demonstrated the feasibility of injection operations and has shown that oil can be moved considerable distances from injection wells with a minimum of bypassing of injected fluids. Gas-injection history indicates that this massive dolomite reservoir should lend itself to successful water flooding, especially in view of the more favorable mobility ratio which will be expected with water as the displacing medium.



1. Afloat 2. Spuds vertical 3. Spuds angled 4. Barge elevated

This Mobile Platform Will Tackle 600-Ft. Water

and it's adapted to mass-production technique

By R. L. LeTourneau

A PLATFORM which will make possible drilling in waters up to 600 ft. has been designed and can be built at a reasonable cost.

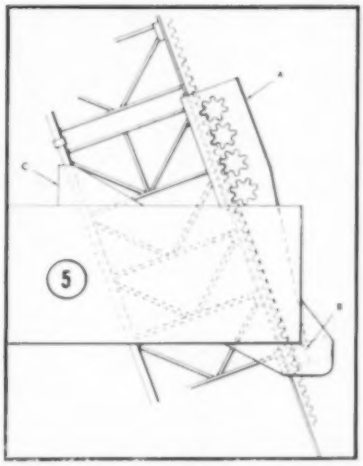
The platform is completely mobile. It can be transferred from one location to another and also will have diesel-electric power to raise itself on its own three legs. It can be economically converted from a mobile-type platform into a permanent-type platform, if so desired.

Stability in these deeper waters is obtained by spreading the platform's legs at predetermined angles—like the angled legs of a conventional tripod. Most of the sections of spud legs will be carried disassembled on the platform's deck, and will be added only after the machine arrives on location and begins lowering its feet to the ocean's floor.

Author is vice president, R. G. LeTourneau, Inc., Longview, Tex. Material from paper presented at A.S.M.E. petroleum mechanical conference, Tulsa.

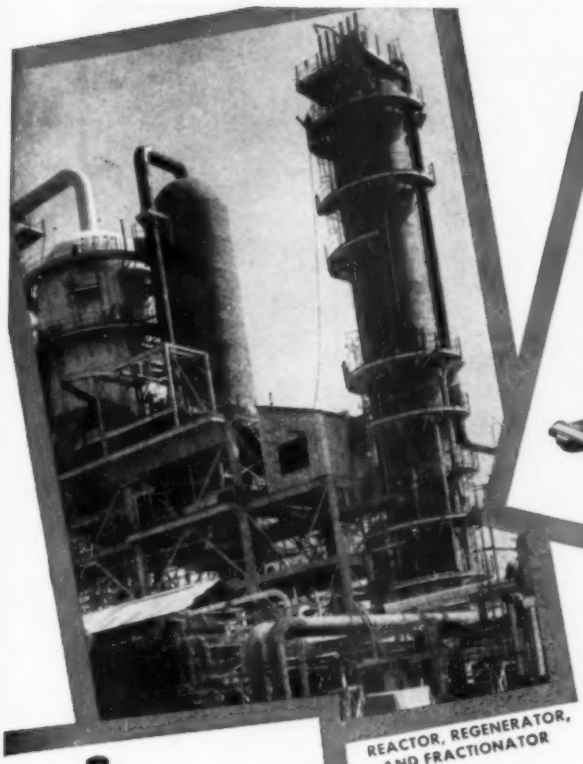
Economics . . . This proposed deep-water design has been cost analyzed with due regard to the mass-production techniques in heavy fabrication that it makes possible. A platform unit capable of drilling 10,000-ft. wells in water depths of 150 to 300 ft. will probably cost $11,000 per foot of water depth. A unit for 20,000-ft. wells in the same water depths will cost perhaps half again as much.

How it works . . . In principle, the unit is a combination self-erecting and self-elevating drilling platform. See Figs. 1-4 for method of operation. In Fig. 1 showing the unit afloat, the unit appears to be a conventional tripod design. Upon arrival at location, additional sections of spud are added with the platform crane while spuds are in vertical position (Fig. 2). Lowering in vertical position is continued until spud feet are about 8 to 12 ft. off of bottom.



5. "Spud locomotives"

The spud feet are designed for pene-



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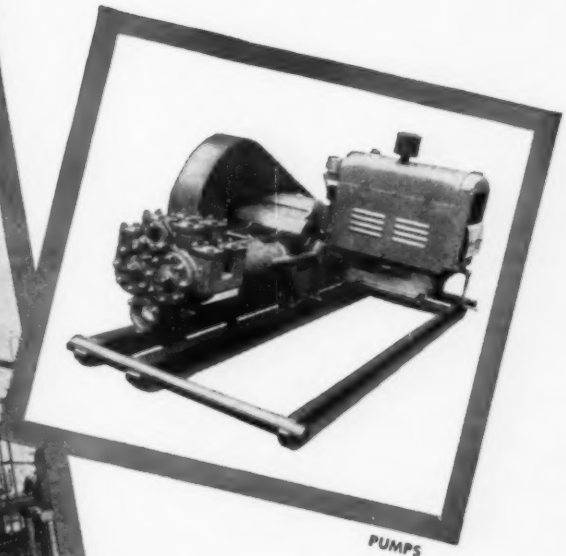
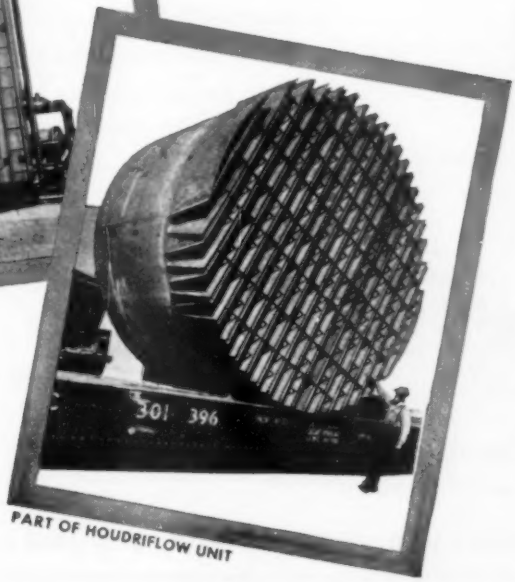


PUMPS

TREATER UNITS



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tration into both hard and soft bottoms. Then, as indicated in Fig. 3, the spuds are set at a predetermined angle and lowered onto or into the bottom. When adequate bottom resistance is encountered, the barge is elevated to the desired height above the waves (Fig. 4).

The platform is elevated by "spud locomotives," each of which is made up of several electric gear motors indicated at "A" in Fig. 5. The spud locomotives are hinged to the barge at "B" to enable the barge to climb its inclined stairways on all spuds at once, or independently for adjustment. Guides within the spud locomotive frames maintain a firm grasp on the rack section of the spuds. Barge guides indicated at "C" provide additional spud to barge bearing.

The spud locomotive drives are gear motors and brake combinations. High-capacity disk brakes on the motors hold the platform in place. An usually high load on any one of the brakes could cause it to slip until the load was picked up and supported equally by each of the brakes.

When the barge arrives at the desired elevation above the water surface, it will be preloaded to its maximum weight and fixed in position. Since the platform in its elevated position is essentially an elevated construction barge, its own heavy-duty crane can unload drilling equipment and supplies from a barge and place them in position on the platform.

It is then ready to drill single or multiple wells, set templates, move off a dry hole, or convert to a fixed platform if adequate production is indicated.

Equipment obsolescence . . . Obsolescence can be minimized with a self-elevating mobile platform so designed that it can serve also as a fixed platform, and eventually left permanently on a site. With the deep-water design proposed, the large crane, and the spud locomotives' diesel-electric-power elevating source, etc., are removable, and could constitute up to one-third of the investment when put in service with another platform.

The remaining two-thirds would be left on location as a multiple-well fixed platform.

Conclusion

Self-elevated mobile platforms as a base for well drilling operations in deep water are practical. Their use in wildcatting is a must. Their economical conversion to fixed platforms for multiple wells will contribute in large measure to reduce oil production costs offshore.

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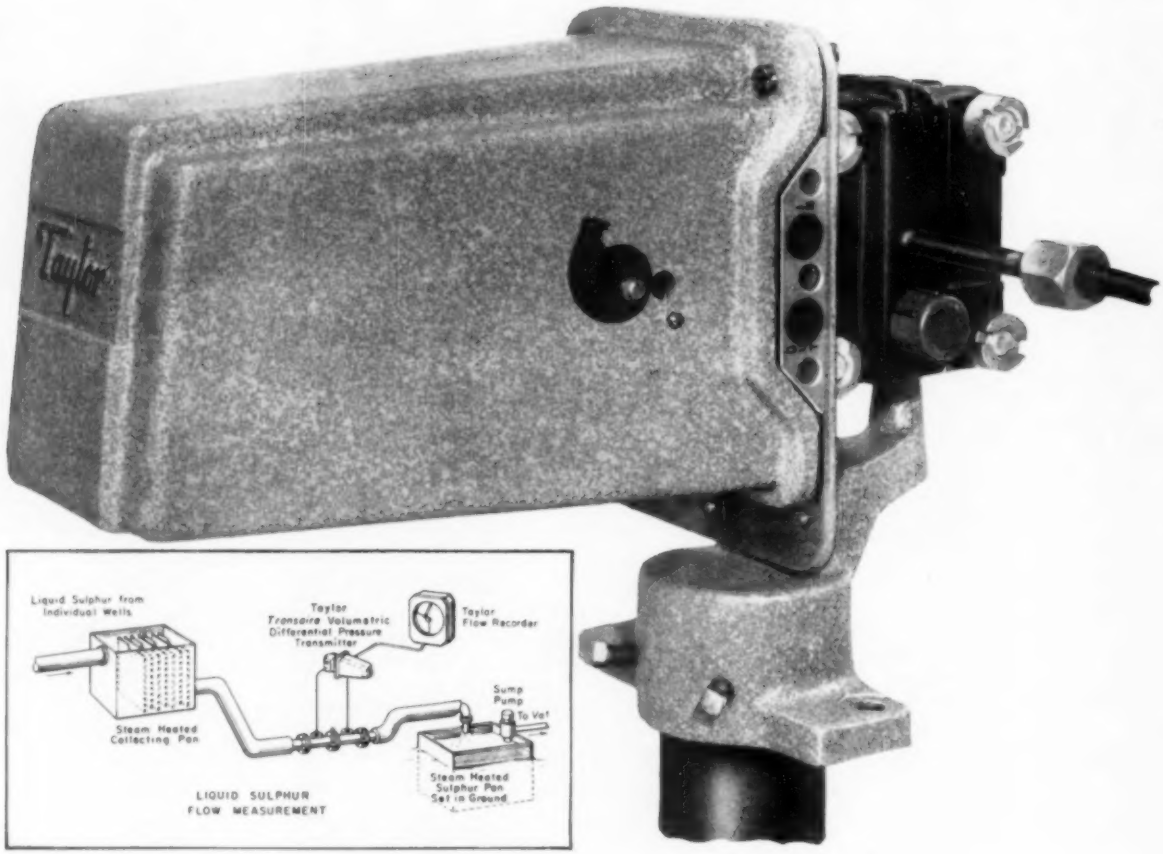
PURGE PROBLEMS
ELIMINATES



Liquid Sulphur from Individual Wells
Taylor Transaire Volumatric Differential Pressure Transmitter
Taylor Flow Recorder
Sump Pump
To Vat
Steam Heated Collecting Pan
Steam Heated Sulphur Pan Set in Ground
LIQUID SULPHUR FLOW MEASUREMENT

Type 95 flange, for use with chemical tee. For flow installations where diaphragm is flush with inside of pipe, so that process fluid imparts a scouring action. Also for liquid level applications where diaphragm should be flush mounted.

New Taylor Volumetric Differential Pressure Transmitter

PURGE, SEAL PROBLEMS ECONOMICALLY!

Ideal for these difficult flow and liquid level measurements:

- Slurries
- Corrosive liquids
- Colloidal suspensions
- Fluids that jell when not in motion.

The new Taylor 205T Volumetric Differential Pressure Transmitter is completely isolated from the process material. Thus it never has to be purged of deposited material, never suffers from corrosion. The pressure-sensitive diaphragms may be installed flush with the inside of the pipe or tank in a variety of mountings. The temperature limit is 300° F. at the diaphragms. Pressure limit of the instrument is 1500 lbs., and the system is limited only by the flange rating on the primary side.

This instrument is a modification of the familiar Taylor 333RD differential pressure transmitter, and is just as accurate, sturdy and dependable. For full details about this new instrument, ask your Taylor Field Engineer, or write for **Bulletin 98281.** Taylor Instrument Companies, Rochester, N. Y. and Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST

VISION · INGENUITY · DEPENDABILITY

Wafer type sensing element, for use with Standard 3" ASA flange, where diaphragm need not be flush mounted with process. For example, corrosive flow or liquid level measurement or colloidal suspensions. Standard diaphragm material, for both types, 316 Stainless steel, Hastalloy B, nickel.

WIRE ROPE AT WORK

The scenic country near Grass Creek, Wyoming, was the setting for this drilling job, which had progressed to a depth of approximately 4500 ft when the photograph was taken. The hole at that time was approaching the Morrison formation. The crew expected to go down another 2000 ft before completing the well.

Owned by the Gist Drilling Company, Casper, the beautiful rig was as neat as a shiny new kitchen. Gist is well known for the excellent condition of his equipment, and his policy of careful maintenance has meant substantial operating economies. He has found another source of economy in the use of Bethlehem rotary line, which is unusually strong, tough, and long-lasting. On the rig shown here, 1¼-in. Bethlehem Purple Strand has proved a reliable workhorse, always equal to any demands imposed upon it.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

PETROLEUM • CONSTRUCTION • EXCAVATING • MINING • QUARRYING • LOGGING • MANUFACTURING

by W. L. Nelson
Technical Editor

COST-imating

Itemized Cost Indexes

THE COST INDEXES on this page may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction Cost Index is published in the first issue each month.

(Multiply the 1946 prices of the COST-imating Series by these Index Numbers divided by 100)

	1949	1952	1954	1955	1956	June 1957	References*	Index for earlier years (The Oil and Gas Journal) in Cost-imating issues
Operating costs (based on 1956 as 100.0):								
Power, electric	109.9	105.1	108.2	103.1	100.0	100.8	Code 5-4	
Fuel, residual	66.0	81.0	86.5	93.0	100.0	117.5		
Gulf cargoes	69.5	78.3	85.9	90.9	100.0	112.7		
N. Y. barges	60.6	84.9	82.6	91.2	100.0	114.0		
S. Pedro bunkers	76.9	79.8	84.3	85.9	100.0	131.4		
Oklahoma	51.2	57.1	62.0	82.4	100.0	112.0		
Industrial chemicals	80.1	95.0	96.9	97.4	100.0	102.2		
Phos. acid	86.7	93.9	96.6	97.5	100.0	100.0	Code 6-11-07	
Sulf. acid	76.1	89.5	100.0	100.0	100.0	100.0	Code 6-11-09	
Ammonia	104.8	94.6	103.0	103.0	100.0	97.0	Code 6-11-13	
Lime		87.7	92.0	93.5	100.0	106.4	Code 6-11-29	
Sod. carbonate	76.7	84.5	92.9	94.3	100.0	104.3	Code 6-11-65	
Sod. hydroxide	73.5	80.6	90.9	94.3	100.0	103.6	Code 6-11-69	
Sod. phosphate	85.3	92.0	95.5	95.5	100.0	100.0	Code 6-11-71	
Furfural		93.6	100.0	100.0	100.0	100.0	Code 6-12-63	
MEK		94.5	94.5	94.5	100.0	103.2	Code 6-12-72	
Phenol		110.6	90.4	92.9	100.0	103.2	Code 6-12-83	
TEL	95.9	105.4	102.8	98.6	100.0	102.9	Supplier	
Operating labor	69.5	81.5	88.7	92.6	100.0	104.7	Employ. and earn.	No. 55—Nov. 3, 1949
Productivity	85.5	90.2	97.1	102.2	100.0	96.6	Employ. and earn.	Sept. 24, 1956§
Construction labor (1946 = 100):								
Skilled construction	133.9	157.9	174.6	179.8	187.3	195.0	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	140.4	168.2	192.1	199.4	209.2	221.3	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	137.1	163.1	183.3	189.6	198.2	208.1		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery	130.5	151.3	158.4	163.8	180.2	185.4	Code ‡11-76	May 2, 1955§
Boilers, tanks, and sheet metal	†134.8	†153.4	147.3	150.3	168.0	173.6	Code 10-72	April 21, 1952§
Building materials (nonmetallic)	151.2	134.8	143.6	149.4	154.0	160.5	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	127.7	140.6	144.7	150.5	159.2	161.6	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	139.8	167.1	193.1	205.9	218.1	235.8	Code 13-42	May 30, 1955§
Castings (foundry products)	150.5	168.0	181.1	185.1	204.7	216.9	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	126.0	145.8	159.1	167.4	176.9	185.3	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	123.7	132.7	142.1	146.6	153.3	159.4	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	121.7	132.6	138.5	139.8	144.9	149.4	Code 13-3	
Electric machinery	130.9	152.4	159.9	162.5	175.0	187.9	Code ‡11-7	May 2, 1955§
Motors and generators	128.7	154.6	157.7	157.1	169.6	180.7	Code ‡11-73	No. 31—May 19, 1949
Switchgear	132.3	161.4	171.2	176.5	194.9	210.3	Code ‡11-75	May 2, 1955§
Transformers	129.7	148.0	161.9	161.8	175.4	186.7	Code ‡11-74	No. 31—May 19, 1949
Engines (composite)	124.8	146.5	150.5	153.2	164.0	173.5	Code ‡11-54	No. 36—June 23, 1949
Exchangers	133.0	165.8	174.5	156.8	193.4	209.6	Manufacturer	No. 2—Oct. 28, 1948
Copper base		175.3	182.0	164.3	196.8	190.0	Manufacturer	
Steel		152.3	149.0	145.3	178.6	224.0	Manufacturer	
Fans and blowers	152.2	183.7	192.6	199.7	222.4	235.8	Code 11-47	Feb. 17, 1949§
Hand tools	134.0	155.1	173.8	185.7	200.3	211.6	Code 10-42	June 27, 1955§
Instruments (composite)	128.1	146.2	154.6	162.9	182.1	186.2	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)	109.2	132.3	161.6	177.2	203.3	203.3	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)	132.4	160.5	179.6	188.6	203.9	208.2	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)	130.2	155.2	146.5	153.5	170.2	170.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	125.8	151.5	167.2	178.6	211.8	229.1	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	131.6	144.9	150.5	164.0	192.3	202.7	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	130.2	158.4	166.3	169.1	187.1	187.1	Manufacturer	No. 34—June 9, 1949
Pressure gage	100.0	108.6	108.6	112.1	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	118.6	149.4	152.8	156.5	170.2	170.2	Manufacturer	No. 34—June 9, 1949
Control valve	129.8	155.5	162.0	166.8	180.9	185.5	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	165.3	203.2	197.8	209.7	214.5	203.2	Code 8-1	No. 7—Dec. 2, 1948
Southern Pine	157.7	191.2	181.2	188.4	195.0	186.8	Code 8-12	No. 7—Dec. 2, 1948
Other soft woods	203.9	248.5	252.7	265.1	266.5	261.4	Code 8-13	No. 7—Dec. 2, 1948
Machinery—general purposes	131.9	151.8	159.9	166.8	183.8	195.2	Code 11-4	Feb. 17, 1949§
Machinery—construction	136.0	157.5	165.9	172.5	187.4	198.7	Code 11-2	
Machinery—oil fields	†132.9	†149.9	†161.9	†168.5	†179.3	187.0	Code 11-51	Oct. 10, 1955§
Paints—prepared	142.8	155.7	159.0	161.4	169.2	177.0	Code 6-21	May 16, 1955§
Pipe, sewer	†119.3	136.9	140.1	149.9	160.5	168.6	Code 13-45	No. 22—Mar. 17, 1949
Pipe, black iron	152.2	179.0	195.0	204.0	233.0	250.7	Code 10-14-56	No. 19—Oct. 15, 1956
Pipe, 6-in. line	†152.0	†174.0	†200.5	†211.8	†241.2	262.9	Code 10-14-58	May 4, 1957§
Pumps, air compressors, etc.	135.9	155.6	166.5	177.2	192.0	203.7	Code ‡11-41	No. 29—May 5, 1949
Steel (iron and steel)	143.3	168.5	179.6	189.9	209.0	223.5	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	173.8	170.0	187.1	196.0	212.4	228.3	Code 10-14	July 25, 1955§
Plate	142.1	163.1	187.0	195.1	215.9	239.1	Code 10-14-36	Mar. 4, 1957§
Structural shapes	152.2	176.2	193.4	204.3	219.1	246.7	Code ‡10-14-31	No. 16—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	140.9	168.8	199.4	211.2	235.5	260.2	Code 10-14-61	Sept. 5, 1955§
Valves and fittings	†132.9	190.8	197.1	208.6	231.9	242.7	Code ‡11-49 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction	139.6	163.6	179.8	184.2	195.3	205.4		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology, The Oil and Gas Journal. ¶Preliminary.

Best way to solve your tube corrosion problems

What heat-exchanger tube alloy best meets *your* specific operating conditions? What effect will a change of alloy composition have on *your* operating and maintenance costs? Will future changes in operating schedules impair the efficient functioning of *your* tubes?

Best way to answer these and many other questions affecting your heat-exchanger tube selection is to ask Bridgeport. Our 60 years of tube manufacturing and corrosion research, backed by modern methods and facilities, have led to the development of a wide range of tube alloys to meet virtually every corrosion problem. Here are some of the standard tube alloys Bridgeport offers:

Admiralty—Good corrosion resistance to most types of circulating water at low velocities. Resists dezincification. Excellent corrosion resistance to clean fresh water and certain types of industrial and sewage pollution. A common choice for refinery heat exchangers where sulfides are present in petroleum streams.

Aluminum Brass—Excellent corrosion resistance to sea water. Resists impingement corrosion where water velocities are high. Excellent corrosion resistance to chlorinated sea water when chlorine is used for slime control. Excellent corrosion resistance to clean and polluted fresh water. Ideal for severe operating conditions.

Copper—Good general corrosion resistance. Good impingement corrosion resistance where water velocities are low. Immune to dezincification. Successfully handles esters, fluorides, oxygen, hydrogen, etc. Excellent heat-transfer rate. Widely used for heat exchangers, evaporators and condensers.

Cupro Nickel—Considered the best copper-base alloy for all-around corrosion resistance toward saline waters. Has unusually high strength at elevated temperatures.

Aluminum Bronze—Good general resistance to impingement and corrosion in brackish water and in areas where water is contaminated by acid wastes. Handles non-oxidizing salt solutions, glycols, esters, halogen derivatives, etc.

Red Brass—Good corrosion resistance in fresh water. Excellent resistance to dezincification. Satisfactorily handles chlorinated organic compounds.

Muntz Metal—Similar to Admiralty in resisting sulfur corrosion. Resists dezincification in sea water, brackish water and most fresh waters.

Duplex—The ideal answer to many dual corrosion problems. Widely used in exchangers handling hydrogen sulfides, chlorides, ammonia and various petroleum products. A range of over 101 combinations available for all refinery and chemical processes.

Bridgeport's Technical Service and Corrosion Laboratories are at your service to help you with specific problems. Call your nearest Bridgeport Sales Office for complete information.

The Bridgeport Condenser Tube Handbook *has 162 pages of valuable information on corrosion and how to combat it. Write for a copy.*

BRASS Bridgeport CO.

BRIDGEPORT CONDENSER TUBES

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Using Electronic Computers in the Oil Industry

How Computers Help Prepare EB Reports

By Anthony F. Marotta
The Datics Corp.

ONE of the most burdensome tasks performed by the accounting department of an oil producer is the filing of required forms with state regulatory bodies. Due to the severe penalties which may arise from incorrect filing, the Monthly Producer's report is perhaps the most important of all these forms.

In the State of Texas this form is commonly called a monthly EB report. To insure proper identification, the report must reflect the field name as designated by the Oil and Gas Division of the Texas Railroad Commission. Operating names and lease names must be reported as established in the latest approved SW-1 (Producers' Certificate of Compliance and Authorization to Transport Oil or Gas from Lease). Likewise, the name of the company gathering oil must be reported as stated on the latest approved SW-1.

Recently the Railroad Commission of Texas has assigned a five-digit serial number to each lease in the state. This number is used as a means of permanent identification for the lease regardless of whether the operating ownership or lease name is changed. If a lease is producing in multiple reservoirs, a separate lease number is assigned for each pool. The lease number assigned to each lease should also be correctly reported.

The total oil on hand beginning of month must agree with the total oil on hand at the end of the previous month for each lease. Otherwise, the producer will be required to file a corrected report.

Actual amount of oil produced is a summation of daily production on the lease for the month. This amount is not to be reported in fractions of barrels and should be adjusted to the nearest whole barrel.

Disposition of oil is an accumulation of the runs during the month and must be entered in total in its respective column on the EB form (pipeline, trucks, tank cars, and other).

Total oil on hand end of month is another key amount, as it should equal the oil on hand beginning of month, plus the actual amount of oil produced minus any disposals. This closing amount must also agree to the opening on the following month's report.

One of the most confusing entries encountered is the reporting of frac oil or circulating oil. The questions that arise are, "Where should it be posted before it is recovered?" and, "Where should it be posted after it is recovered?" With the possibility of charging this oil against the allowable twice (through error), it is best to check with the district office of the Railroad Commission prior to filing for instructions. There are many factors involved in the proper reporting of this oil. The origin of the load oil is one example. It may have been transported from another lease or it may be oil produced on a lease on which the well being loaded is located.

In view of the voluminous reporting of some companies, errors are made innocently either typographically or through transposition. Time is an important factor, as all reports are to be filed prior to the fifteenth of the month with the district office to which the oil field applies.

With the aid of high-speed punched-card accounting machines or computers, the preparation of these monthly reports can be simplified to a great extent. More accurate reports are compiled and the time saved in the mechanical processing relieves personnel for non-routine tasks.

The punched cards used in preparing these reports become a permanent record which can be used for future analyses, if required. The advantage of having this information in punched-card form is in its flexibility. As an example, royalty checks may be compiled based on the same information required in reporting production.

The comparison of opening and previous closing can be accomplished at tremendous speeds, signaling any inconsistencies for correction. Checking reports to ascertain balance in crossfooting likewise is performed in a minimum amount of time. In some systems both of these checking operations can be performed simultaneously.

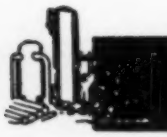
Such repetitive information as field names, operating names, lease names and serial numbers, gathering company, etc., can be stored in punched cards or magnetic tape, depending on the system. This operation would be required only once in the initial processing, and would be kept current from that point on. Consequently, errors which ordinarily occur in month-to-month typing are completely eliminated. Data accumulated during the month is then applied for final reporting with extreme accuracy.

With a system such as this, manual work which previously required days to perform is now reduced to hours.

The form design of the production report submitted to the state regulatory body must meet with their approval. A sworn affidavit must accompany this form. This affidavit perhaps may be attached or be incorporated as part of the form.

The machine method of reporting is currently in use by one or two companies as they recognized the need for a new system to relieve their peak work loads. More companies, including independent operators, are changing to the automatic procedures.

By James L. Griffin



FIELD PROCESSING

NATURAL GASOLINE REFINING

Gas Measurement

Second of a two-part article

Industry Constantly Improving Proved Methods

THE first installment of this two-part article appeared in the September 9 issue. While apparatus for the testing of gas to determine its supercompressibility and effect on measurement are readily available, the cost of such apparatus is high. It requires skilled operators and considerable time to obtain the supercompressibility factor.

A.G.A. Measurement Report No. 3 contains methods and tables from which this factor may be obtained when the gas analysis is known. Factors obtained by this method compare to within 0.2 per cent with factors obtained by the testing apparatus.

HgS, CO_2, and water content . . . Instruments for automatically determining and recording hydrogen sulfide, carbon dioxide, and water content have been developed and are presently being used to safeguard the quality of pipeline gas. These instruments will produce duplicate charts at some distant location. They will operate alarms, signal lights, and control valves to either shut off gas supplies entirely or divert the gas stream from the pipeline when the diluent content reaches a predetermined amount.

Continuous calorimeters . . . With the possible exception of the petrochemical industry, which converts natural gas into other products, industrial customers are buying heat. The spot checking of heating values with the old Junkers type of flow calorimeter has given way to continuous recording calorimeters.

Testing and calibrating these instruments has been simplified and the time periods extended between inspections with a standard gas supported by a U. S. Bureau of Standards certificate of heating value. Several companies air condition the rooms where calorimeters operate. Controlled temperatures improve the machine's performance and accuracy.

Author is with Northern Natural Gas Co. at Omaha, Neb. Paper presented at American Gas Association transmission conference at San Francisco.

Designers and users of gas-burning equipment frequently request analysis of the gas that is proposed for use in their particular equipment. Formerly such analysis was obtained by a combination of selective absorption and combustion from which the various components could be calculated or by fractional analysis. The development of a low-priced mass spectrometer has made it possible to obtain the fractional analysis in a matter of minutes as compared with hours for other types of equipment.

Better orifice plates . . . The experimental work conducted in the preparation of Reports 2 and 3 brought to light the need for making orifice plates of better steels that would keep a true sharp edge longer. Stainless-steel orifice plates are now used widely. Special orifice fittings have been developed where plates can be removed for inspection and replacement with a minimum of labor. By the use of weld ends on the upstream side, such orifice flanges and fittings can provide an uninterrupted internal wall surface from the outer end of the inlet meter tube to the section adjoining the orifice plate.

Orifice fittings that permit orifice changes with a minimum of effort and without interrupting gas flows are a convenience over the flange union and are being used more.

Meter-run surfaces . . . Research work is being conducted to determine the effect of meter-run surfaces on gas measurement. Tests on this are under way at U. S. Naval Boiler and Turbine Laboratory at Philadelphia, under supervision of A.G.A. The findings of this research may lead to a more precise control and closer tolerance in the manufacture of meter tubes.

Pulsation problem . . . Another of the current research projects being conducted by A.G.A. is in the study of the pulsation problem where orifice meters are operated in the vicinity of compressor stations. This project is now in progress at Southwest Research Institute. It is hoped that this will lead to practical methods of isolating meters from these pulsations or possibly a formula for correcting the errors from this source.

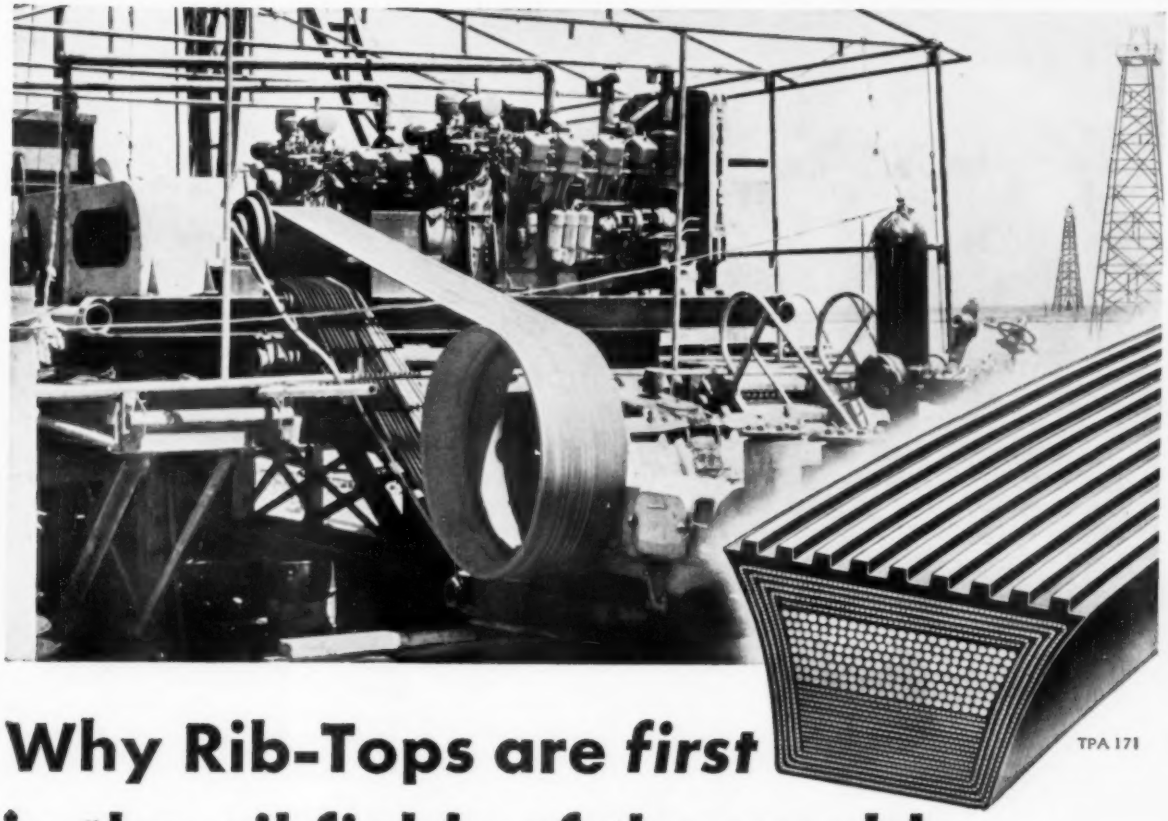
The present supercompressibility tables in Report No. 3 are limited to maximums of 0.75 specific gravity, 5 per cent carbon dioxide, 12 per cent nitrogen, and 3,000 psig. As there are instances where natural-gas metering is involved in conditions exceeding these limits, A.G.A. has a research project studying the extension of these tables to much wider limits.

The 1957 A.G.A. Gas Measurement Committee has a subcommittee studying the possibility of another research project on the disturbance effect of upstream pressure-reducing valves on orifice measurement.

Another project of the Gas Measurement Committee is the preparation of a gas-measurement manual for which a need is felt in the industry, particularly in the training of measurement personnel and as a guide to standard or widely used practices.

Electronic tabulation . . . Considerable advancement has been made in recent years in the use of electronic, tabulating machines in the calculating of meter volumes from the charts and the making up of reports and data for billing. This has worked to shorten the time between receiving charts and reporting volumes and tends to reduce the interval between the close of the billing period and the date the customer receives his bill.

The basic principles and methods of gas measurement have not changed. Several new methods have been proposed such as artificially set up electric currents and sound waves, but these methods still require much research before being approved for commercial use. Greatest activity has been proving and expanding tried and true methods. **End.**



TPA 171

Why Rib-Tops are *first* in the oil fields of the world

The four engineering developments shown at the right have made Rib-Top first choice for mud pump operation with drillers around the world.

Yet Rib-Tops cost no more than ordinary belts of comparable ratings.

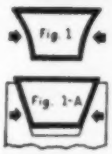
For fewer V-belt replacements and lower cost on mud pump drives, always specify Rib-Top. Both Standard and Super Rib-Top are available at your nearby oil field supply house.

Put Super Rib-Top on your toughest drives.

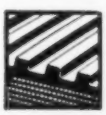
With 40% more horsepower capacity, Super Rib-Top easily handles drive overloads. Fewer belts and narrower sheaves solve space and weight problems.

No other V-Belt has ALL these advantages

1. **Tougher, more resilient cords** are able to absorb the severe pulsations of mud pumps; easily handle peak loads.



2. **Concave Sidewalls** (U.S. Pat. 1813698) Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . far longer belt life.



3. **Stabilizing ribbed tops** (U. S. Pat. No. 2548135) are exclusive with Gates. They dampen vibration, protect top of belt from damage, keep belt running smoothly over idler-equipped mud pump drives with no side whip.

4. **Flex-Weave Cover** (U. S. Pat. 2519590) A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer . . . increases belt life . . . more power available to driven machine.

The Gates Rubber Company
Denver, Colorado

Gates® *World's Largest Maker of V-Belts.*

Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

No. 2 in a series . . . Reed Rock Bit **Firsts** in Famous Fields

Reed Rock Bits

BEST IN 1926
BEST TODAY!

As the oil activity in the Texas Panhandle was assuming major proportions, Reed was introducing a revolutionary new design in rock bits . . . the first rock bit with slush lubricated rolling cutters. Today, as a result of this pioneer design, all bits with rolling cutters are slush lubricated . . . but let's go back to the exciting days of Borger, most prolific of the Panhandle fields.

On January 11, 1926, the Dixon Creek Oil and Refining Company brought in their No. 1 Smith well at 10,000 barrels a day and one of the most notorious oil booms in Texas began. Borger has been described as a wild, "rootin'-tootin'," "hell-raisin'" place—much like Dawson's Klondike gold-rush days. Its two-mile-long street was lined on either side with a hodge-podge of quickly constructed buildings—the Betty Jane Hotel, Murphy's Dance Hall, Dewdrop Inn, Stagg's Pool Hall, chili parlors, barber shops and numerous entertainment joints. Thousands of workmen poured into the bustling community, plus thousands of others ready to make a quick buck by any means. The Texas Rangers finally took over to bring order out of the chaos, much as they had done in Mexia. But Borger flourished and the field expanded so rapidly that only nine months after discovery there were 813 wells producing 165,000 barrels of oil daily.

During the early days of the Panhandle boom, Reed's first rock bit with slush lubricated rolling cutters was a highly popular improvement over any rock bits of the time. *Today*, the most advanced concepts in rock bit design are incorporated in Reed Y Bits—providing the maximum rate of penetration and maximum bit life.

BEST IN 1926 . . .

First rock bit with slush lubricated rolling cutters, Reed Standard Model

BEST TODAY . . .

REED Y BIT

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This is the second of a series of four paintings on the history of famous oil fields. To obtain your FREE 17 x 14" full color prints suitable for framing of the entire series, send your request to Department H. Reed Roller Bit Company.

BORGER OIL FIELD · 1926 Borger's two-mile row, with derricks in background. This teeming boom town was founded in February, 1926, on a 240 acre plot and grew to a population estimated at 15,000 in only nine months.

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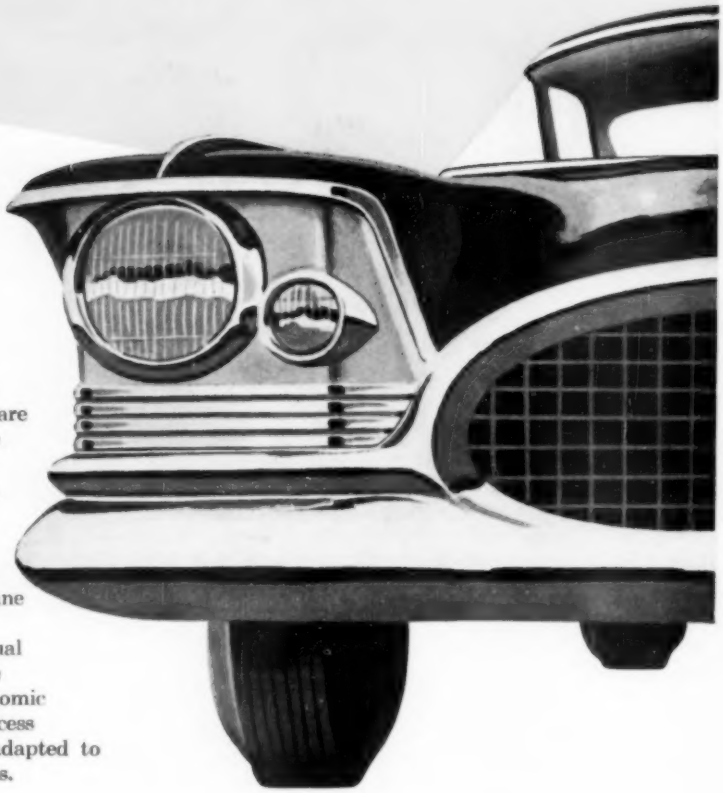

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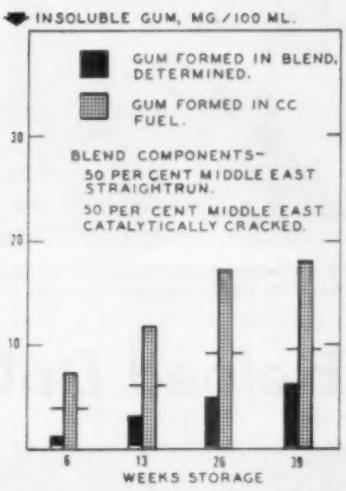
PIONEER IN CATALYTIC PROCESSES

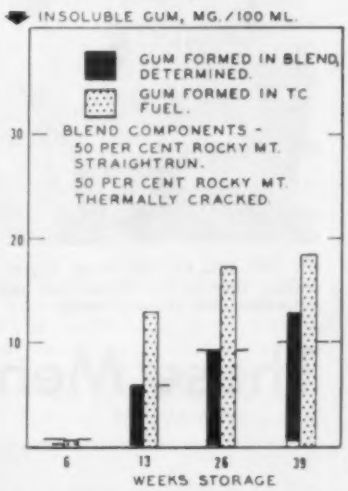
Storage Stability

Does Thermal Cracking Affect Stability?

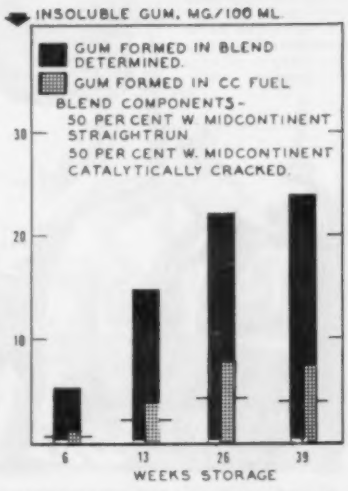
By F. G. Schwartz and C. C. Ward



SUPERCOMPATIBLE binary blend. Fig. 3.



COMPATIBLE binary blend. Fig. 4.



INCOMPATIBLE binary blend. Fig. 5.

THIS part of the series continues with an examination of the data from the initial storage program.

300 series blends: Additional binary blends. Data obtained on blends of fuels stored in the original storage program showed that the binary blends yielded more information regarding the compatibility of the fuels than did the tertiary or quaternary blends. The compatibility of 31 binary blends originally prepared and 36 supplementary binary blends on an insoluble gum basis is summarized in the following tabulation:

	Incompatible		Compatible		Supercompatible		Total	
Blends—	Frequency	Per cent total	Frequency	Per cent total	Frequency	Per cent total	Frequency	Per cent total
SR-CC	15	65	7	30	1	5	23	100
SR-TC	9	47	6	32	4	21	19	100
TC-CC	5	50	3	30	2	20	10	100
SR-SR	1	20	4	80	0	0	5	100
CC-CC	2	20	6	60	2	20	10	100
Total	32	48	26	39	9	13	67	100

Authors are with Petroleum Experimental Station, Bureau of Mines, USDI, Bartlesville, Okla.

400 series blends: Thermally cracked fuels added to blends of straightrun and catalytically cracked fuels. Examination of the data from the initial storage program showed that most of the blends that included a thermally cracked fuel were compatible and five of them were supercompatible. This led to speculation as to whether thermally cracked fuels might have a stabilizing effect.

To check this possibility the 400 series blends were made using straightrun, catalytically cracked, and thermally cracked fuels from four geographic areas. Five blends were made of the fuels from each area. In each of the four series of blends the percentage of thermally cracked fuel was kept constant at 20 per cent and the other components varied from 80 per cent straightrun to 80 per cent catalytically cracked by increments of 20 per cent.

The presence of thermally cracked fuels in these blends had no definite effect on stability.

500 series blends: Blends in which percentages of components are varied. All of the binary blends in the original storage program were equivolume blends, and the question was raised as to how large a percentage of the cracked fuel could be added to straightrun fuel without incompatibility. The 500 series blends consisted of straightrun and cracked fuels, with the percentages of cracked fuels ranging from 20 to 80, in 20-per cent increments. The data for these blends indicate the percentages of cracked and straightrun fuels in a blend of maximum incompatibility may vary, depending upon the particular components blended.

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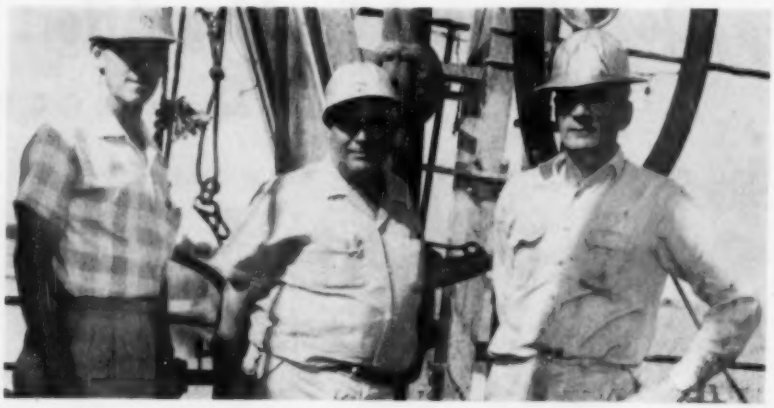
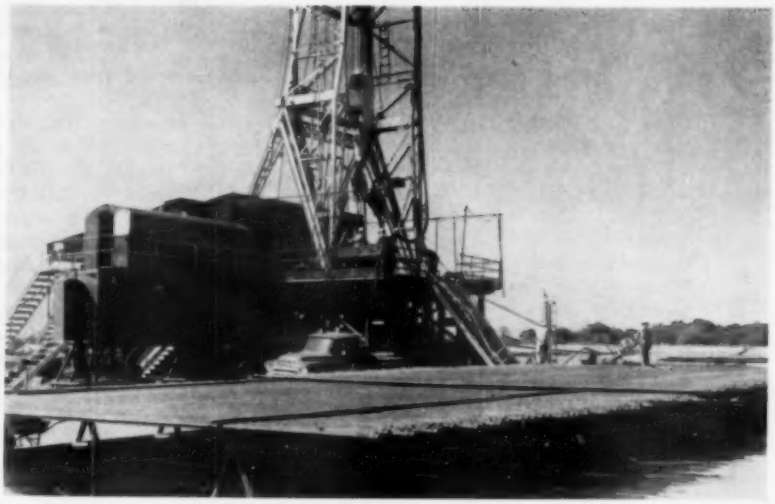
Among the Drilling Contractors



ON THE RIG FLOOR Wayne Rogers (left), production superintendent, and J. Calahan, production foreman, British-American; and Glen Adair (right), Viersen & Cochran, driller, take a breather after running tubing.

These Men Helped Drill



THIS IS Viersen & Cochran's heavy-duty rig which drilled British-American's deep producer in the Knox area. Picture shows separator set up for testing well's flow.

Oklahoma's Deepest Well

Viersen & Cochran, contract-drilling firm working out of Okmulgee, Okla., has the distinction of having drilled Oklahoma's deepest producing well.

The newly completed well, 1 Krieger, drilled for British-American Oil Producing Co., is on the Stephens County side of the deep Knox area, in the southern part of the state.

Its production is gas from the lower Simpson-Oil Creek zone, perforated at 16,526-46 ft. Flow was gaged at 6,200,000 cu. ft. daily through ⅞-in. positive and 13/64-in. adjustable chokes.

Hole was drilled to 17,484 ft., at which depth it is the state's fourth deepest test. No major trouble was encountered during its drilling. Drilling

began October 12, 1956. Below the 20-in. conductor at 118 ft., 13-in. casing was cemented at 3,880 ft., 9-in. at 13,781 ft., and the 7-in. oil-string at 16,674 ft. Open hole carried below the 9-in. protection string totaled 3,703 ft.

Two Lewis Rigs Drilling On New Rocky Contracts

Will I. Lewis Drilling Co., Mount Vernon, Ill., has transferred two Rocky Mountain tool pushers for new contract jobs. Dee Gilbert moves from Cut Bank, Mont., to Cody, Wyo., where he is on an 8,100-ft. Madison wildcat test Lewis is drilling for Richfield Oil Corp. on its Carter Mountain Unit, in Park County. Horace Kirby goes from Browning to Miles City, Mont., for a Dominion Oil Co. contract, 1 Jordan-State, in Custer County.

Edna Contractor Moves

Henry Cleveland, who has been operating as a drilling contractor out of Edna, in Jackson County, South Texas, now is located at Shreveport, La. He is running two rigs, one capable of drilling to 5,000 ft., and the other to 2,000 ft.

Tucker Drilling Co., San Antonio, Tex., has a new 6,000-ft. contract operation in Schleicher County, West Texas. Operator is Caulkins Oil Co. of Oklahoma City. Location is 12 miles southeast of Eldorado at 1 Page, in the 30-L-GH&SA Survey. It is 1¼ miles southeast of Page (Strawn) field.

Circle Drilling Co., Lake Charles, La., has a new contract operation for Sunray Mid-Continent Oil Co. in southwestern Beauregard Parish, South Louisiana. Location is 3 miles southwest of Cowards Gully field, nearest production. Spot is in 30-7s-11w, at 2-B Lutcher-Moore. A 10,000-ft. test is planned.

Thomas Drilling Co. and **M & J Drilling Co.,** Midland, Tex., are the contractors on two wildcats tests getting under way in Lea County, southeastern New Mexico. Thomas has McGrath & Smith's 1 Phillips-State, in 34-20s-35e, 20 miles northeast of Eunice. It is 3 miles west of Lynch field. Contract is for 4,200 ft. M & J is on B. L. McFarland's 1 Holder-Ross, in 26-16s-36e, 3 miles southwest of Lovington, and about 2 miles from production. Plans call for a 4,200-ft. Queen test.

Kerr-McGee Oil Interests, Inc., Oklahoma City, will be the contractor on Atlantic Refining Co.'s proposed 10,500-ft. test in the Gulf of Mexico off the Texas coast. Location is about 7 miles offshore from Matagorda Peninsula in State Tract 446 (large), Brazos area. It is 15 miles south of Matagorda townsite, in Matagorda County. Nearest production is in Kane field, 18 miles northeast.

Southeastern Drilling Corp., Dallas, will drill another test for Union Oil Co. of California on the latter's OCS-0559 lease in Block 67, Vermilion area, in the Gulf of Mexico, 15 miles off shore from Vermilion Parish, Louisiana. Drilling is projected to 7,600 ft. Location is about 3 miles from a shut-in gas well drilled by Pure Oil Co.

Crow Drilling & Producing Co., Shreveport, has contracts for two additional wells Durbin Bond & Co., Inc., of Little Rock, will drill in the newly discovered Mean Lake area, 4½ miles southeast of Harrisonburg, in Catahoula Parish, eastern Louisiana. Both will be 5,000-ft. tests, which will carry the holes through the 4,370-ft. Wilcox zone found productive in Durbin Bond's discovery well. One, at 2 Tensas Delta, will be northeast of the discovery. The other, 3 Tensas Delta, will be due north of the discovery. Both locations are in 32-9n-7e.

Penrod Drilling Co., Shreveport, has taken a new contract job in Evangeline Parish, South Louisiana. It is for Charles H. Lawrence, Jr., of Lake Charles, at 1 Forest, in 21-3s-2w, 6½ miles northwest of Reddell field, in the western part of the parish. Permit calls for a 10,100-ft. test.

Vick Drilling Co., Winnsboro, La., has a new wildcat operation in Anderson County, East Texas. It is a 6,250-ft. Woodbine test for F. R. Jackson, H. Whitehurst, and John B. Moore. Location, a wildcat, is 9 miles northwest of Grapeland, in the Sarah Little Survey, on the operators' Etta Little lease.

Jack Halbert Drilling Co., Tyler, Tex., will drill a 6,100-ft. Woodbine test for Sam King, of Dallas, at a wildcat location 1½ miles northeast of Slocum, in Anderson County, East Texas. Location is for 1 Day, in the Jesse Gibson Survey.

Maxwell Herring Drilling Corp., Kilgore, Tex., has a rig working on a newly started 8,500-ft. Rodessa test it has contracted to drill for General Crude Oil Co. of Houston in Wood County, East Texas. Location, at 1 Barrett, in the M. L. Burnett Survey, is about 3 miles southwest of Pine Mills.

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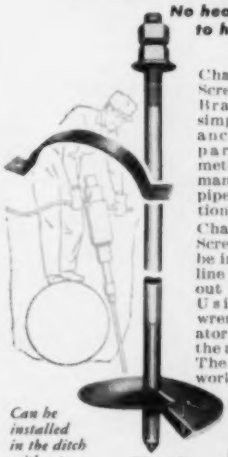
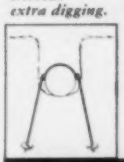


Can be installed in the ditch without extra digging.



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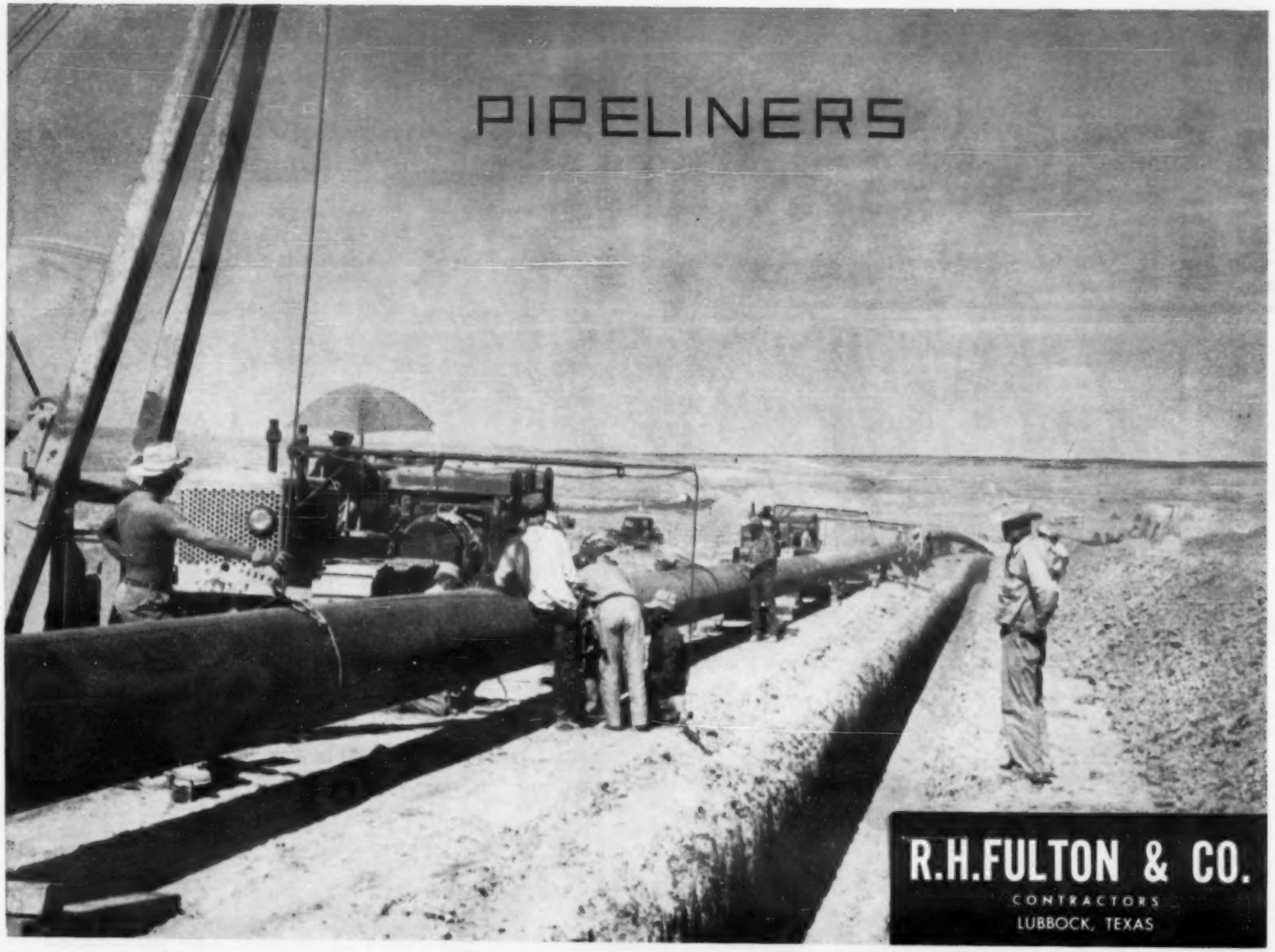
PIPELINERS
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Now for the first time, a 6-in. . . .

Pipeline transports gilsonite solids

By Robert K. Bond

TRANSPORTATION of 700 tons per day of gilsonite solids through a 72-mile 6-in. pipeline was an engineering challenge for Standard Oil Co. of California. Nothing comparable was in operation to guide this undertaking, and pilot testing on anything but a small scale was out of the question.

However, by carefully analyzing and extrapolating the results from the small-scale costs, the full-scale commercial pipeline has been engineered. The pipeline is now operating successfully (see Fig. 1 for profile and hydraulic gradient), and the original design basis can be scrutinized in light of actual operating data.

On April 15, 1957, the first gilsonite was transported by pipeline, climaxing the engineering development of a most vital link in a refinery project involving an investment of over $15 million. (See OGJ, Aug. 5, 1957, p. 57, and Sept. 16, 1957, p. 189.)

American Gilsonite Co., jointly owned by Standard Oil Co. of California, and Barber Oil Co., requested Standard's engineering department to develop and build this unusual transportation system.

Ideal material . . . Preliminary studies indicated gilsonite would be ideal material to carry in water and pump in the form of a slurry. Its specific gravity is only 5 per cent greater than water and it is relatively nonabrasive.

Tests were made on 500-ft. loops of 2 and 6-in. pipe through which slurry was continuously circulated to determine flow characteristics of the suspended solids, pipeline corrosion, reduction in particle sizing due to hydraulic transport, etc. These tests were conducted at the Colorado School of Mines Research Foundation in Golden, Colo.

Pressure drop . . . Flow-velocity curves obtained in the pilot tests with gilsonite slurries having a rather wide range of solids concentration showed the same characteristic behavior found by many other investigators using solids of greater specific gravity. The pressure drop was primarily a function of flow velocity, dropping to the values for clear water above a certain critical velocity.

Below this critical velocity, which has no precisely defined value, the pressure drop was considerably greater than for water. Size distribution of the solids in the slurry affected the pressure gradient curves considerably. This can be seen from the friction-factor Reynolds number curves of Fig. 2. Reynolds numbers were calculated from water viscosity.

The amount of minus 200-mesh particles in the slurry (the majority probably only a few microns in diameter) appears to be an important factor in establishing pressure-drop behavior. When large amounts of minus 200-mesh solids were present, the pressure drop in the test loop was higher than water at velocities above the critical.

Full-scale pipeline . . . In establishing a basis for the design of the full-scale pipeline, a reasonable allowance was included for variables that could not be fully explored in the pilot tests. An allowance of 75 per cent was therefore added to the pressure gradients observed at Golden to cover these factors:

. . . Additional pipe internal roughness over test conditions.

. . . Effect of low temperature on slurry flow resistance in excess of that accountable to water viscosity change alone.

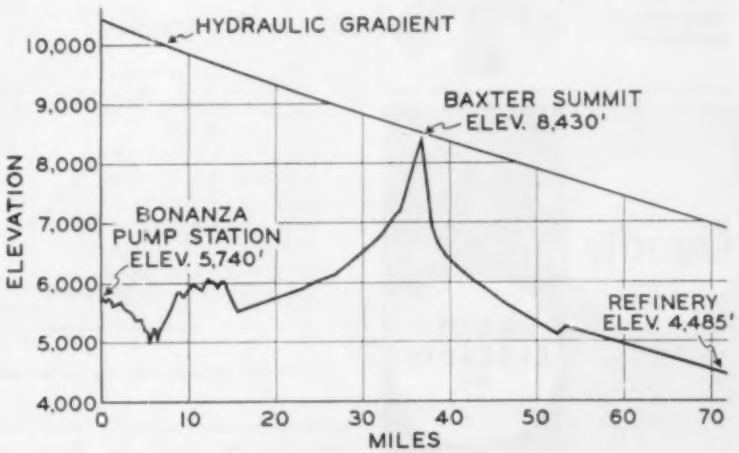
. . . Effect of changes in elevation of the pipeline.

. . . Effect of chemical dispersing agent in the pilot tests not necessary in the commercial pipeline.

A chemical dispersing agent was added to the slurry in the test loop. Otherwise, fine gilsonite particles formed a sludge with air and water. Air could not be completely eliminated from the system because the flow rate was measured by weighing the throughput at intervals. The viscosity effect of the dispersing agent is shown in Fig. 2.

Much of the pressure-drop data obtained at Golden were of little value in establishing the final design. The results were affected greatly by the chemical dispersing agent and the excessive degradation of the solid particles in the system.

Safety factor . . . Operation of the pipeline indicates that little or none



PROFILE and hydraulic gradient of the 72-mile pipeline. Fig. 1.

Author is with Standard Oil Co. of California, San Francisco.

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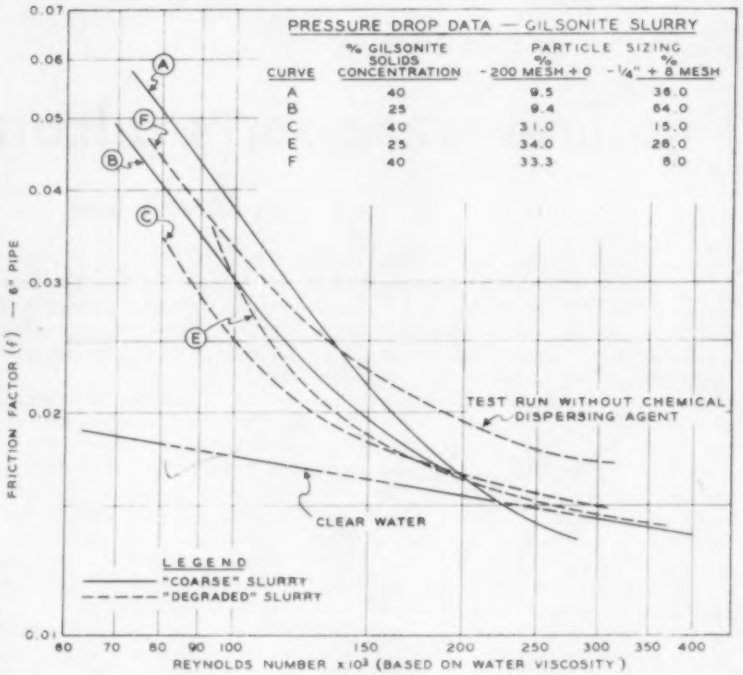
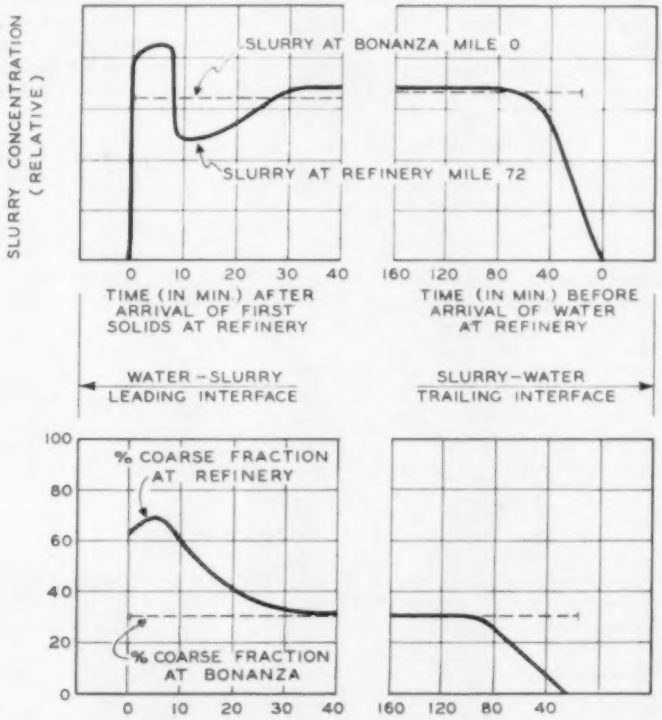

PRESSURE DROP DATA — GILSONITE SLURRY
CURVE | % GILSONITE SOLIDS CONCENTRATION | PARTICLE SIZING % -200 MESH + 0 | % -¼" + 8 MESH
A 40 9.5 38.0
B 25 9.4 64.0
C 40 31.0 15.0
E 25 34.0 28.0
F 40 33.3 8.0
FRICTION FACTOR (f) — 6" PIPE
0.07
0.06
0.05
0.04
0.03
0.02
0.01
TEST RUN WITHOUT CHEMICAL DISPERSING AGENT
CLEAR WATER
LEGEND
"COARSE" SLURRY
"DEGRADED" SLURRY
80 70 80 90 100 150 200 250 300 350 400
REYNOLDS NUMBER x10³ (BASED ON WATER VISCOSITY)

VISCOSITY effect of the chemical dispersing agent which was added to the slurry. Fig. 2.


SLURRY CONCENTRATION (RELATIVE)
SLURRY AT BONANZA MILE 0
SLURRY AT REFINERY MILE 72
0 10 20 30 40
160 120 80 40 0
TIME (IN MIN.) AFTER ARRIVAL OF FIRST SOLIDS AT REFINERY
TIME (IN MIN.) BEFORE ARRIVAL OF WATER AT REFINERY
WATER – SLURRY LEADING INTERFACE
SLURRY – WATER TRAILING INTERFACE
% COARSE FRACTION AT REFINERY
% COARSE FRACTION AT BONANZA
100
80
60
40
20
0
0 10 20 30 40
160 120 80 40

SOLIDS increase was due to an accumulation of larger size particles. Fig. 3.

of the pressure-drop safety factor provided in the design for these unknowns has been required.

The low-pressure gradient in the operating line provides a highly desirable reserve of extra line capacity. Actual-

ly, the lower friction factor realized, along with surprisingly high volumetric efficiency for the constant-speed reciprocating pumps, give a station-discharge pressure not much below the maximum pressure expected in the design.

Actual operation of the pipeline has demonstrated that little attrition occurs in the 72-mile line. Only a slight increase in minus 200-mesh particles has been detected. Filter-cake moistures of from 14 to 16 per cent have been experienced, rather than the 20 per cent provided for in the design.

Minimum-flow velocity . . . The primary criterion for design of the pipeline was that the flow velocity should be above the minimum necessary to keep the particles in complete suspension. Then the entire cross-section of the pipe is effective for flow.

Fortunately, since gilsonite is an unusually light material, the 3.4 ft. per second velocity selected is in the range commonly used for conventional pipelines where flow velocity is determined only by economics. This velocity is roughly 20 times the settling velocity in water of the larger particles contained in the slurry.

At Golden, some larger particles of gilsonite were tagged with a radioactive tracer to determine their actual velocity so as to be certain that the minimum velocity selected was adequate to carry all of the solids in suspension. These relatively large particles, some $\frac{3}{8}$ in. in diameter, traveled at speeds that were at least equal to and usually higher than smaller particles.

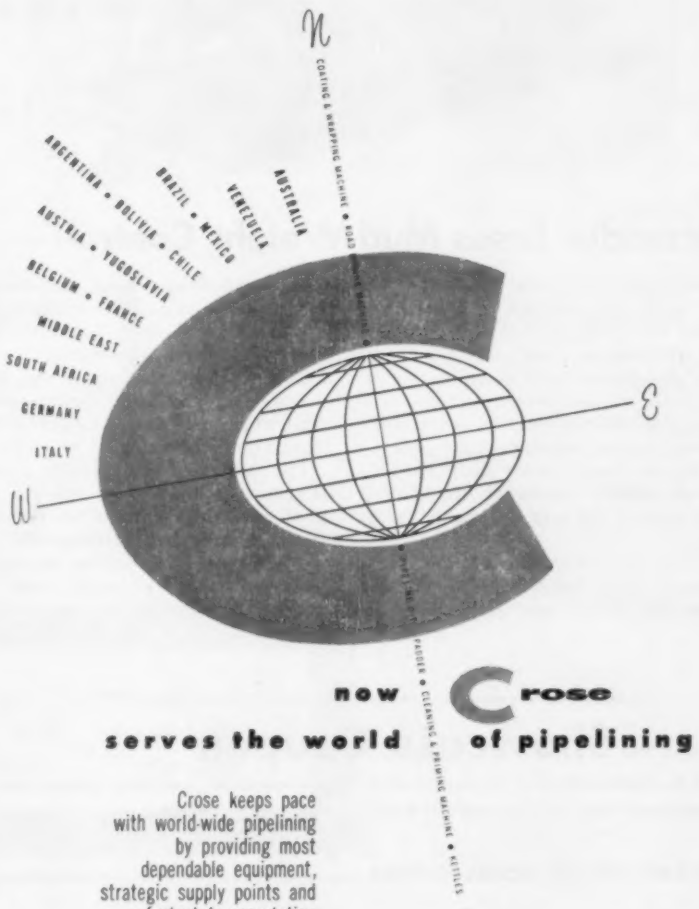
This type of behavior has been observed in the operating pipeline. Unexpectedly, the leading water-slurry interface of several batches showed a significant increase in solids concentration over the average for the batch. The solids increase in this zone was due to an accumulation of larger size particles as can be seen from Fig. 3.

Line capacity . . . The capacity of the pipeline can probably be increased to 1,000 tons per day using the present pumping equipment. Installation of an intermediate booster pump station would increase the capacity to more than 1,700 tons per day.

To take advantage of high volumetric efficiencies, which undoubtedly relate directly to pump maintenance and valve life, the top particle size in the pipeline was limited to approximately 8 mesh. The pumps are plunger type, equipped with spherically seated steel valves of standard design, and have given excellent performance.

Erosion and corrosion . . . Unlike many ores, gilsonite will not abrase steel surfaces to any measurable extent. It is insoluble in water and is naturally free of impurities. Because of these properties, no significant allowance for erosion or corrosion was made in establishing wall thicknesses for the pipeline. Following conventional pipeline practice, the slurry line was designed with a pipe wall stress of 65 per cent of the yield strength of the steel, although the minimum wall thickness was limited to $\frac{7}{16}$ in.

Even though gilsonite is not believed to be significantly erosive, a conventional chemical corrosion inhibitor must be used to prevent corrosion of the line by dissolved oxygen in the water. If no inhibitor were used, corrosion rates would be extremely high because the solids scour away the oxide film as it forms. **End.**



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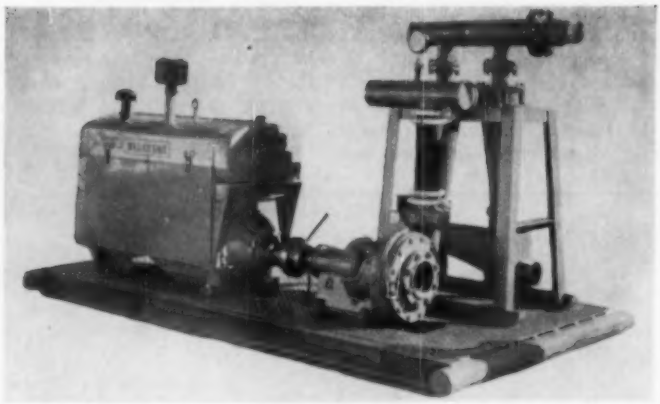

Desander Eases Mud-Weight Control

Shown here is a new unit for removing sand and cuttings from drilling mud. It's called the Demco Desander. All wear surfaces are protected by oil and abrasion-resistant neoprene ½ in. thick. A molded neoprene liner, protecting the interior surfaces of the unit's conical steel separating chamber, may be replaced at necessary intervals. This feature extends indefinitely the life and efficiency of the unit, the maker points out.

If the liner wears through, mud seeps through signal holes in the side of the cone indicating a need for relining.

Using centrifugal force, the desander separates sand particles or cuttings in a size range from 20 to 325 mesh from the drilling mud, according to the maker. The device can thus save valuable weighting and lost-circulation material while removing sand and so help control mud weight.

The desander is reportedly capable of removing from 77 to 100 per cent of all sand and cuttings. A two-cone unit will treat from 300 to 500 gal. of drilling mud per minute, depending upon mud viscosity, weight, and sand content.

The unit is skidded for easy mounting. Its overflow header and underflow trough can be turned 180° for ease in connecting. Mud moves in a straight line to and from all headers. **Write or call: Drilling Equipment Mfg. Co., P. O. Box 4728, Oklahoma City, Okla., for details on desander.**

New Differential-Pressure Controller Available

This new Model 237 Barton pressure controller features a ruptureproof bellows unit. The controller comes in differential-pressure ranges from 0 to 20-in. water to 0 to 50 psi. with static pressure ratings up to 6,000 psi. A variety of housing materials are available, including aluminum, steel, alloy steel, and stainless steel.

Control actions include on-off, differential-gap, and proportional. Proportional-plus-reset or proportional-plus-rate are optional. The controller, using a supply pressure of 20 psi., has an output of 3 to 15 psi., with 6 to 30 psi. optional. **Write or call: Barton Instrument Corp., 580 Monterey Pass Road, Monterey Park, Calif., for details on Model 237 controller.**

●

Drain Control Now Made in 3-In. Size

Besides the original 2-in. size, this new Oil Miser drain control is now being offered in a 3-in. A.P.I. thread size. The 3-in. size is designed to use an O-ring between the plastic and the tee to which it assembles to prevent leaks.

The drain control is a visual-inspection device which allows an operator to bleed bottoms from lease tanks without

Send this **Showcase Coupon**

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NAME AND/OR MODEL NUMBER.....

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Described in OIL AND GAS JOURNAL - Issue of **October 7, 1957**

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COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

IF YOU USE

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Start new rig with one rotary hose	$1919.42	Standard price Rotary Hose
Two vibrator hose	940.88	Standard price 15′ Vibrator Hose
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When hose needs replacing—

With Goodall—		With Conventional hose—	
2 vibrator hose @ $150.00 each (made from old rotary hose)	$ 300.00	Standard price Rotary hose	$1919.42
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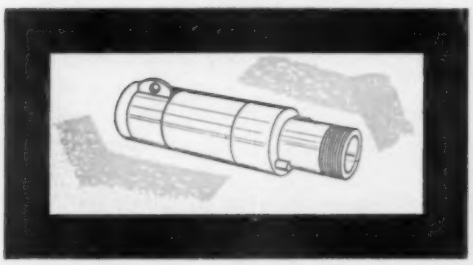
Total Goodall Cost	$2219.42		$3801.18
		Cost of replacement with Goodall Hose	−2219.42
		YOU SAVE with Goodall	$1581.76

Goodall Hose is completely guaranteed for one year.



The Barney Coupling and permanent built-in safety clamps

GOODALL RUBBER COMPANY

TRENTON, N. J.

Goodall Rubber Company of Texas: Houston, Odessa, San Angelo, Texas.
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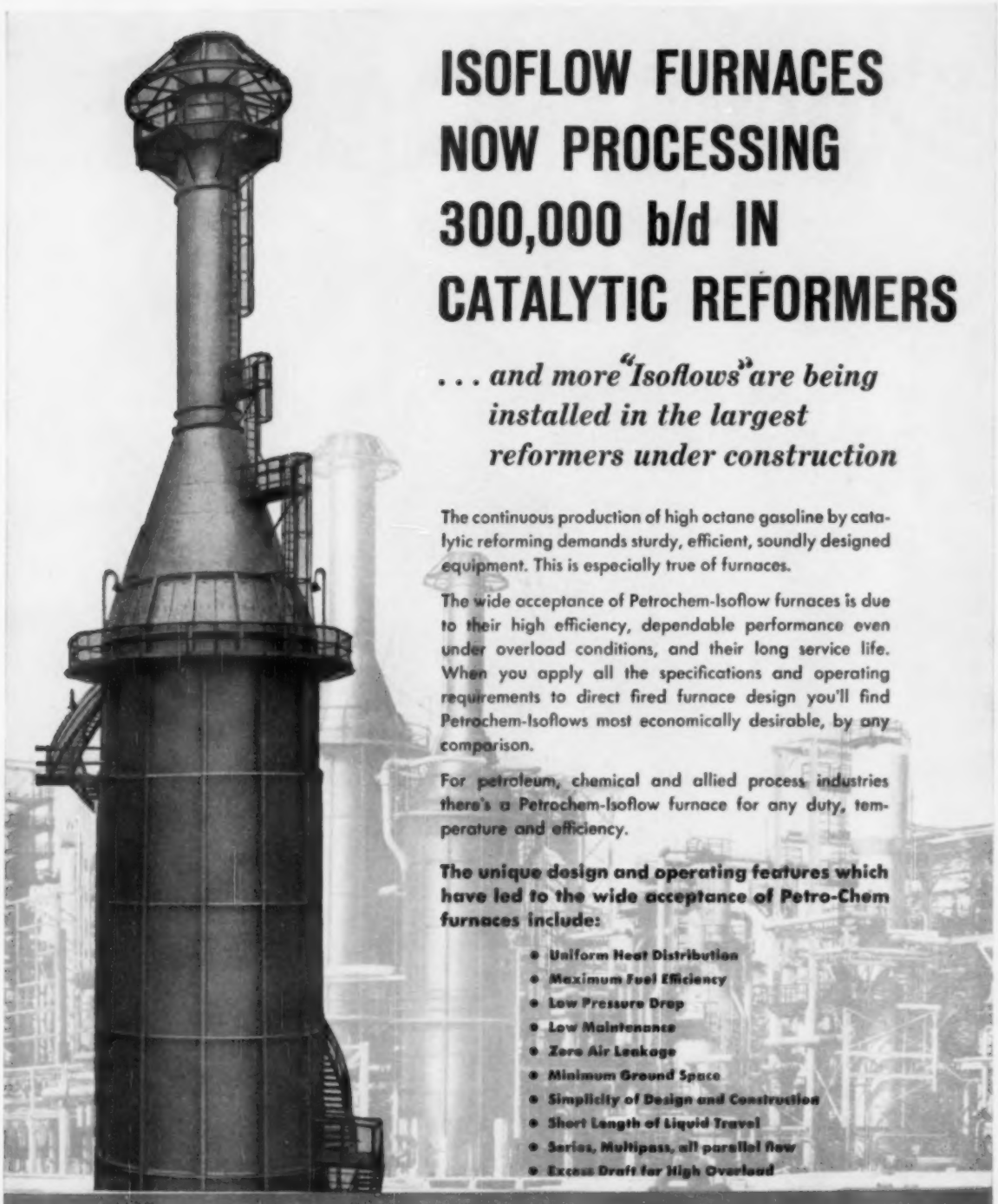
Export: Goodall Rubber Company, Trenton, N. J.
Stocking Distributors: Texas and Louisiana—Houston Oil Field Material Co., Wilson Supply Co., Hunt Tool Co., Heap Equipment Company; Iverson Supply Co.

Available through all qualified supply stores



ISOFLOW FURNACES NOW PROCESSING 300,000 b/d IN CATALYTIC REFORMERS

. . . and more "Isoflows" are being installed in the largest reformers under construction

The continuous production of high octane gasoline by catalytic reforming demands sturdy, efficient, soundly designed equipment. This is especially true of furnaces.

The wide acceptance of Petrochem-Isoflow furnaces is due to their high efficiency, dependable performance even under overload conditions, and their long service life. When you apply all the specifications and operating requirements to direct fired furnace design you'll find Petrochem-Isoflows most economically desirable, by any comparison.

For petroleum, chemical and allied process industries there's a Petrochem-Isoflow furnace for any duty, temperature and efficiency.

The unique design and operating features which have led to the wide acceptance of Petro-Chem furnaces include:

- **Uniform Heat Distribution**
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- **Minimum Ground Space**
- **Simplicity of Design and Construction**
- **Short Length of Liquid Travel**
- **Series, Multipass, all parallel flow**
- **Excess Draft for High Overload**

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UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

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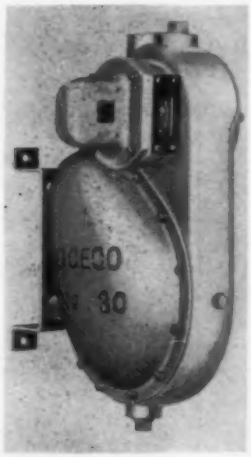
SHOWCASE . . .

New Equipment

bleeding off good oil. When the device is installed immediately downstream from the bleed valve, bleeding can be stopped immediately as soon as oil appears in the bulb, thus saving many barrels of oil normally wasted in the bleeding operation, according to the maker.

The new 3-in. size is 5 in. longer. It is threaded to fit a standard 3-in. tee. Employing a heavy wall section of cellulose acetate butyrate plastic, the drain control will withstand pressures to 100 psi. at 130° F. It is baffled for positive control at any position around the pipe. The baffle is easily removed for ease in wiping out the bowl. **Write or call: Barrier Corp., P. O. Box 464, Mineral Wells, Tex., for details on 3-in. Oil Miser.**

●



Tank Gage Adapts To Remote Reading

High accuracy is provided by this new Oceco No. 30 tank gage, the company reports. The gage is said to have proved exceedingly accurate during tests conducted in conformance with A.P.I. gaging committee standards and on tanks under actual service conditions.

The maker says the gage can be inspected and checked easily and quickly, is readily adapted to remote reading, and can be installed easily on new tanks or those already in service.

To reduce friction or drag, all shafts, including those in the gage housing and sheaves, are stainless steel and supported on Rulon bearings. The shafts are free turning and the gage is sensitive to any change in liquid level under all temperature and service conditions, the maker states. No grease or lubricant are needed. Too, the gage compensates for the weight of the tape mass, assuring accurate gage regardless of the height of the liquid in the tank. **Write or call: Johnston & Jennings Co., 6917 Bessemer Avenue, Cleveland, Ohio, for details on No. 30 tank gage.**

●

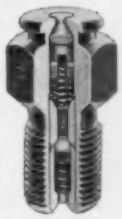
Hydraulic Drill Is Easily Moved

This Carey HHP drill is a lightweight unit that can be transported in small packages and quickly assembled on location, the maker reports. Providing a

DELTA
HIGH PRESSURE GUN

This is no ordinary gun. It incorporates many important advantages and safety factors. Handles heaviest lubricants. Develops 10,000 lb. pressure. Positive mechanical spring primer. 30,000 lb. test barrel is cold rolled seamless steel tubing with heavy end sections and safe coarse threads. Hose tested to 20,000 lbs. Fast snap-on coupler enables operator to lubricate 10 to 15 valves *better, faster* and *safer* than he can one valve by conventional methods.

DELTA "GIANT" API BUTTON HEAD FITTINGS



These are the only guaranteed button head fittings on the market. Unconditionally guaranteed not to leak at 15,000 lbs. pressure. Why can we do this? Because they have a one-piece steel body. Precision parts. Double check valves; metal-to-metal seats. There are sizes and types for any plug valve in any service. Holds valve pressure, retains lubricant, protects personnel. Insist on them.

DELTA-DESCO

WRITE FOR CATALOG
The Only Complete Plug Valve Lubrication Company

PLUG VALVE LUBRICANTS AND EQUIPMENT

Color Coded Lubricants • Hand Guns
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Another successful use for BAKER Packers... parallel string installations

Baker Retainer Production Packer Product No. 415-D

FEATURES

Holds any pressure from either above or below that is safe for the casing, even under temperatures in excess of 300°F.

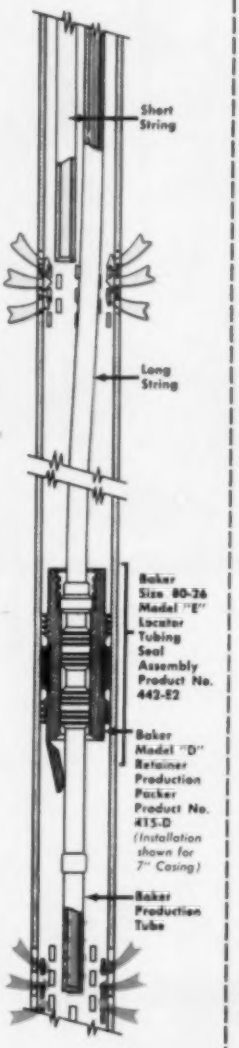
Pack-off is independent of set-down weight or tension. Tubing string is free; just pick up (or unlatch and pick up) to remove it.

Use it as a squeeze and testing tool or as a temporary or permanent bridge plug in conjunction with any production application.

BAKER OIL TOOLS, INC.
HOUSTON • LOS ANGELES • NEW YORK

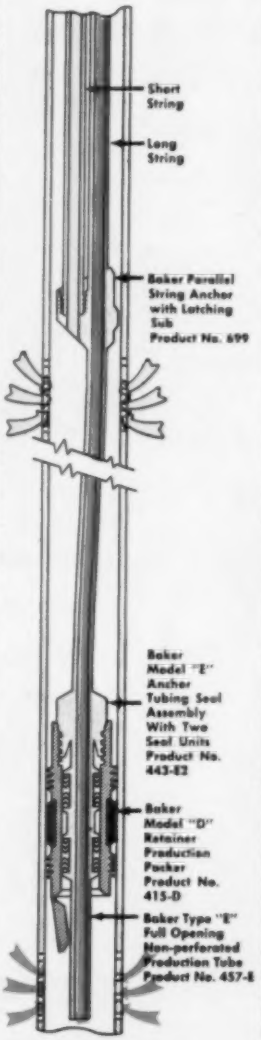
BAKER

DUAL ZONE parallel string SHORT STRING HANGING FREE


Short String
Long String
Baker Size 80-26 Model "E" Locator Tubing Seal Assembly Product No. 442-E2
Baker Model "D" Retainer Production Packer Product No. 415-D (Installation shown for 7" Casing)
Baker Production Tube

Permits removal of either string independently of the other regardless of sequence. Full-Opening (Tubing I.D.) Long String to lower zone.

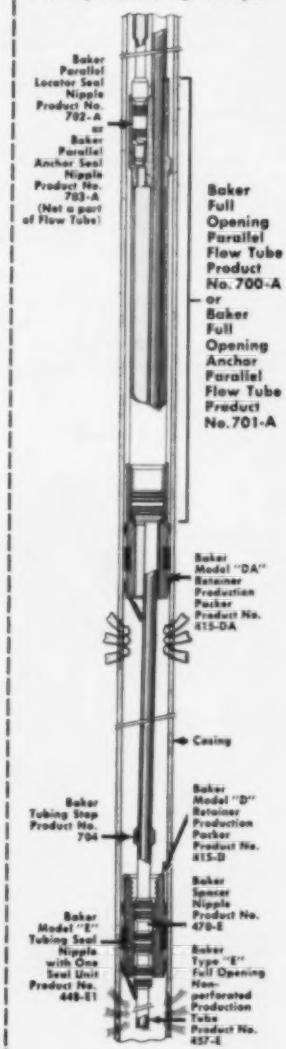
DUAL ZONE parallel string SHORT STRING ANCHORED


Short String
Long String
Baker Parallel String Anchor with Latching Sub Product No. 699
Baker Model "E" Anchor Tubing Seal Assembly With Two Seal Units Product No. 443-E2
Baker Model "D" Retainer Production Packer Product No. 415-D
Baker Type "E" Full Opening Non-perforated Production Tube Product No. 457-E

Permits removal of either string independently of the other, however long string must be run first. Short string pulled first. Full-Opening (Tubing I.D.) Long String.

DUAL ZONE parallel string TWO-PACKER HOOK-UP*

**Ask for details of "Retrievable Upper Packer" installations, and other parallel string hook-ups.*


Baker Parallel Locator Seal Nipple Product No. 702-A or Baker Parallel Anchor Seal Nipple Product No. 703-A (Not a part of Flow Tube)
Baker Full Opening Parallel Flow Tube Product No. 700-A or Baker Full Opening Anchor Parallel Flow Tube Product No. 701-A
Baker Model "DA" Retainer Production Packer Product No. 415-DA
Casing
Baker Tubing Stop Product No. 704
Baker Model "D" Retainer Production Packer Product No. 415-D
Baker Spacer Nipple Product No. 470-E
Baker Model "E" Tubing Seal Nipple with One Seal Unit Product No. 448-E1
Baker Type "E" Full Opening Non-perforated Production Tube Product No. 457-E

Illustrates Two-Packer parallel string installation with each zone confined to its individual tubing string with full-opening to lower zone for use of all permanent-type completion tools.

SHOWCASE . . .

New Equipment

drilling depth to 200 ft., the drill weighs 725 lb.

The swivel, built into the rotary, uses a steel wear ring and two neoprene packing rings. Hydraulic pulldown provides continuous travel and a speed of 0 to 80 ft. per minute, controlled by a hydraulic valve.

The mast is 9 ft. 9 in. high. The rotary, fitted with steel gears lubricated by an oil bath, turns at 130 r.p.m. The engine is an Onan 12.9-hp. unit. A mud pump is optional. **Write or call: Carey Machine & Supply Co., Inc., P. O. Box 63, Houston 1, Tex., for details on Model HHP hydraulic drill.**

●

Automatic Choke Keeps Tubing Pressure Constant

This choke, called the C.T.P., flows and controls a well automatically within the limits of the maximum and minimum positive chokes, the maker claims. Thus each well can operate on the best combination of chokes to suit the particular well, from sizes 3/64 to ½ in. Maximum and minimum chokes are easily changed when necessary.

According to the maker, the choke can be adjusted to produce the exact allowable without shutting in the well. And the choke operates on any type of well—high or low pressure.

In low-pressure wells, or wells that produce excess water or tend to load up and die, the automatic feature of the choke reportedly will keep the well unloaded or flowing. When the tubing pressure drops, the well will continue to flow at the set rate due to the automatic arrangement that allows fluid to pass through the larger choke in inverse proportion to the drop in tubing pressure. **Write or call: Gulf Coast Machine & Supply Co., P. O. Box 1150, Beaumont, Tex., for details on C.T.P. automatic choke.**

Forced-Feed Lubricator Dispenses Uniformly

In this new McCord Model 55 lubricator, the maximum plunger displacement is a fixed quantity. Thus the number of drops of a certain viscosity oil will be uniformly the same, the maker points out. With a ¼-in. diameter plunger, the plunger displacement is 0.0184 cu. in.

Even though slippage should occur at high pressure, it is diverted back to the sight-feed cup, automatically reducing the oil intake on the next

2 MORE CHAMPIONS . . . FROM THE SAME STABLE

H & M offers *complete visibility* in pipe cutting and beveling. H & M's *Flexible Shaft* and the H & M *Motorized Unit* both allow the operator to stand *in front* of the pipe being beveled and observe the bevel through the complete 360 degrees.

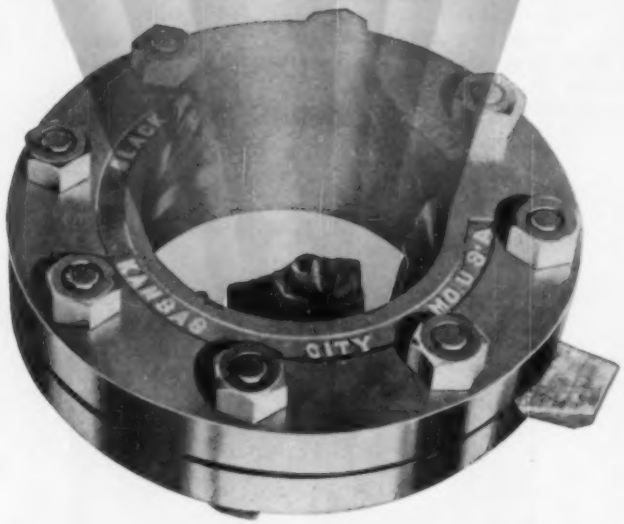
The FLEXIBLE SHAFT attaches quickly and easily to any H & M machine, and allows the operator a full view of the circumference of any size pipe, while regulating the speed of the torch.

The MOTORIZED UNIT provides complete automation of pipe cutting and beveling, and is easily and economically attached to any H & M machine. With an easily-regulated, governor-controlled motor, consistently smooth and perfect cuts and bevels are attained . . . AUTOMATICALLY.

Write today for fully illustrated details of the complete H & M line.

H&M PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TULSA, OKLAHOMA
TM Reg

This "heart-failure" can lengthen someone's life!



Pictured above is what happens when a pressure vessel protected by a BS&B Safety Head develops pressures above safe limits. "Heart" of the Safety Head is the rupture disc, which bursts to relieve the overpressure instantly and completely—guarding against injuries to personnel and damage to plant equipment.

BS&B Safety Heads

protect pressure systems in every type industry

Thousands of BS&B Safety Heads are today protecting millions of dollars worth of property and equipment and countless human lives. There's a BS&B Safety Head suitable for many types of pressure systems containing air, gas, steam or liquid.

BS&B Rupture Disc—"Heart" of the Safety Head

BS&B rupture discs are designed to relieve pressures at any specified point from 3 to 100,000 pounds per square inch. They are available in standard sizes ranging from ¼ inch to 36 inches in diameter, and in special sizes and types for virtually any application.

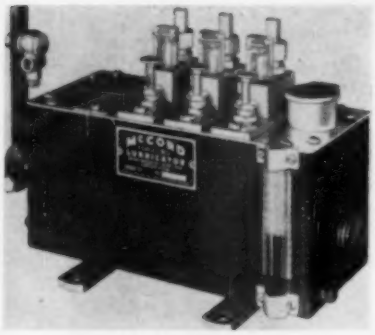
If you use any type of pressured system, let us tell you more about BS&B Safety Heads and rupture discs. Call or write your nearest BS&B office or representative—or write to . . .

BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-A10
7500 East 12th St.
Kansas City 26, Mo.

SHOWCASE . . .

New Equipment



plunger stroke. This feature makes it possible to obtain precise accuracy in the lubricator feed, the maker says.

Settings for a given amount of oil over a given period of time are simple. They in no way involve the lubricator speed or oil viscosity.

The lubricator gives controlled-volume setting. It doesn't rely on internal porting. **Write or call: Lubricator Div., McCord Corp., Rio Poll and Grand Boulevard, Detroit 11, Mich., for details on Model 55 lubricator.**

•

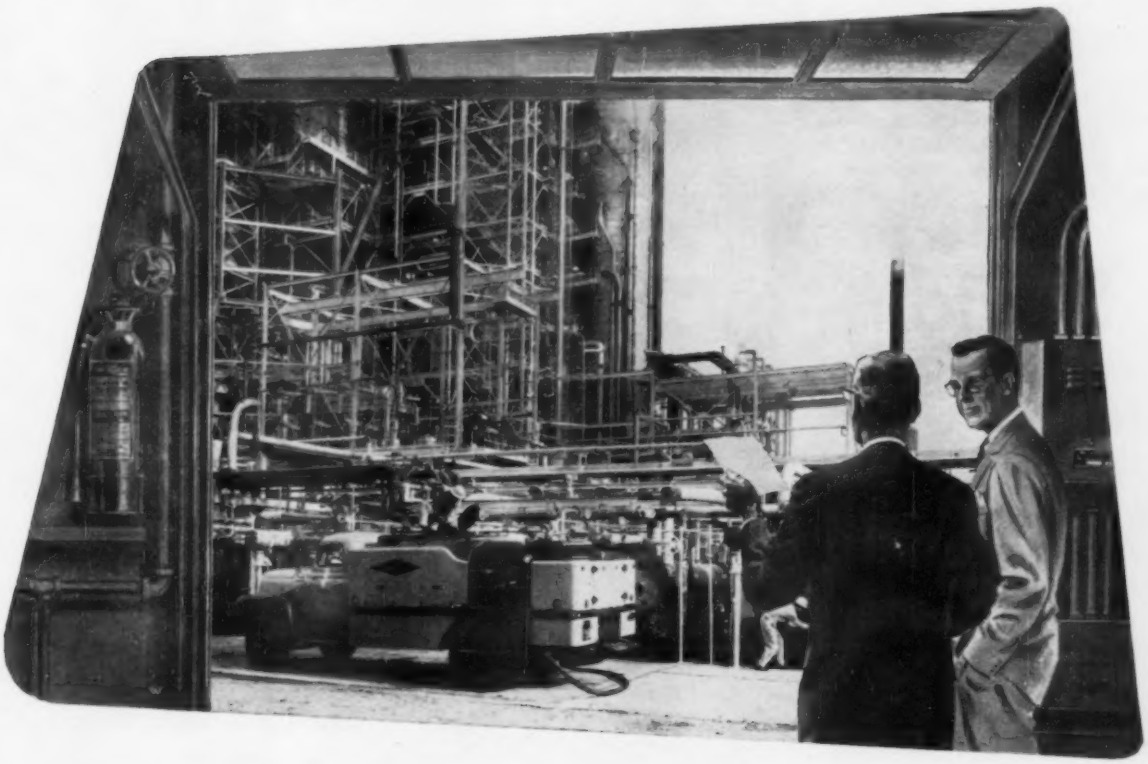
Combination Machine Cleans and Wraps Pipe

Both cleaning and wrapping can be done with this new CRC machine, the maker says. The machine consists of a standard CRC cleaning and priming machine with the priming attachment removed. In its place, a wrapping-head assembly is universally mounted to the cleaning-machine frame.

Because of its pivoted attachment, the wrapping head is always perpendicular to the pipe, even on sharp bends. Thus, the lap being applied is always constant, the maker claims. A patented variable-drive design is used in getting a fine adjustment of the lap.

Combination cleaning and wrapping

Dowell Service Helped This Plant Profit By Saving $312,700 in Maintenance Costs!



To clean and service the giant catalytic crackers in today's modern refineries is quite a job . . . and very costly. Costly, that is, unless Dowell Service is on the job to help clean the "cats"—chemically. Here's an example of how Dowell chemical cleaning service cut turnaround costs for one refiner by $312,700.

Dowell was called in to provide cat cracker turnaround service which included the cleaning of: two flue gas coolers, two catalyst coolers, four overhead aftercoolers, one light gas oil cooler, one heavy gas oil cooler, two top tray reflux coolers, and two final gas condensers.

Dowell's time: thirteen and one-half hours; Cost: $2300.

It is estimated that this same cat cracker service, if done by mechanical methods, would have cost the refinery: 1) Additional downtime of seven days—$210,000; 2) Additional spare bundle inventory—$100,000; 3) Labor—$5,000.

The refinery enjoyed a $312,700 operating credit from this single cat cracker turnaround—not including expected efficiency increases.

Dowell provides expert service in removing scale and sludge from product, process and steam generating systems. Dowell does the job for you—furnishing all chemical solvents, trained personnel, pumping and control equipment. Furthermore, Dowell has the experience in chemical cleaning to provide assurance of a job well done.

While the example here deals with an oil refinery, Dowell chemical cleaning has recorded similar profit-making savings for other industries. Dowell engineers can show you performance data in almost any field — steel, chemical, power, paper, construction.

For specific information on how Dowell chemical cleaning can help your plant to greater profits, call the Dowell office nearest you. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

have Dowell clean it chemically DOWELL

A SUBSIDIARY OF THE DOW CHEMICAL COMPANY

SHOWCASE . . .

New Equipment

by such a single unit eliminates the use of extra pipe cradles, side booms, and labor, thereby reducing costs, according to the manufacturer. The cleaning and wrapping machine can be obtained to accommodate all pipe sizes. And the wrapping head can be fitted with a two or four-arm setup. **Write or call: Crutcher-Rolfs-Cummings, Inc., P. O. Box 2073, Houston, Tex., for details on dual-purpose cleaning-wrapping machine.**

Fuel Pump Provides Variable Delivery

All grades of fuel at pressures to 200 psi. and temperatures to 250° F. can be handled by this Type 200 oil fuel pump, the maker reports. Of the positive-displacement variable-delivery type, the pump can be mounted vertically, as shown, or horizontally. A control permits varying the output from zero to full flow.

Made in England, the pump is said to be self-priming, self-lubricating, and silent. Its output can be regulated while the pump operates.

For handling diesel oil, the pump's capacity ranges from 175 gal. per hour at 1,420 r.p.m. and 50 psi. to 60 gal. per hour at 950 r.p.m. and 200 p.s.i. **Write or call: Plenty & Son, Ltd., Eagle Iron Works, Newbury, England, for details on Type 200 pump.**

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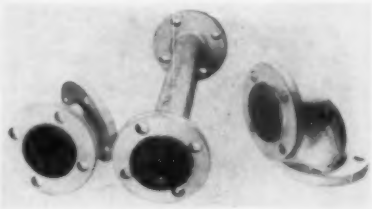


Lined Pipe and Fittings Handle Hot Acids, Caustics

A corrosionproof piping system is obtainable with this Fluoroflex-T-S lined pipe and fittings, according to the maker. They are lined with a patented high-density Teflon compound called Fluoroflex-T1001. The compound is chemically inert at temperatures up to 500° F., except for molten metals and fluorine at elevated temperatures and pressures, the maker reports.

The pipe is designed especially to handle all hot acids including hydrofluoric and aqua regia, and caustics in applications where high temperatures and/or pressures accelerate corrosion, such as in acid-recovery systems, and acid treatment of petroleum.

Jacketed with Schedule 40 seamless-steel pipe with 150-lb. A.S.A. flanges threaded and welded at each end, the pipe liner is formed over the full gasket face of the flanges so that it becomes an integral one-piece gasket and liner.

Elbows, 45° and 90° types are available with the same liner, using standard 125-lb. A.S.A. cast iron and 150-lb. A.S.A. cast-steel (short radius) housings in sizes from 1 to 4 in. **Write or call: Resistoflex Corp., Roseland, N. J., for details on Fluoroflex-T-S lined pipe.**

Floridin

Adsorbents
Desiccants
Diluents

around the WORLD

Floridin fuller's earth (aluminum magnesium silicate mineral) is recognized throughout the world for superior selective adsorption in laboratory and industrial separation processes.

From the basic Floridin, specialized processing increases the pore volume and available surface area. Commercial Floridin grades are unequalled in high quality and low cost:

- **Fuller's Earth Products:** Florex—for oil refining, Florigel—for collodial suspensions, Florco—for absorbent cleaners, and Diluex—for pesticide formulations.
- **Activated Bauxite Products:** Florite Desiccant—for gas and liquid dehydration and Florite—for petroleum refining.
- **Synthetic Adsorbent Products:** Florisil—for a highly selective chromatographic adsorbent.

Our experienced adsorption specialists are available to help solve complex laboratory or production problems. Write for samples and technical information today.

FLORIDIN COMPANY

Adsorbents
Desiccants
Diluents

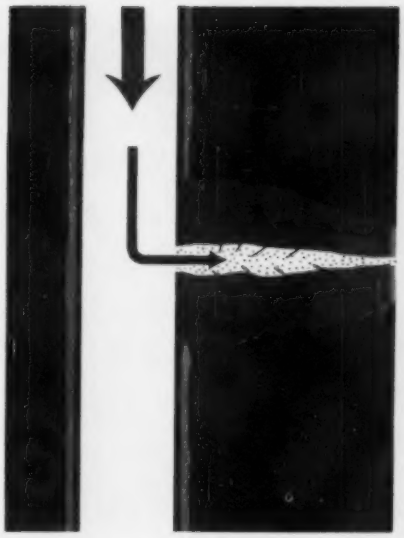
DEPT. C P.O. BOX 989 TALLAHASSEE, FLORIDA

FLUID LOSS
STEALS FRACTURING POWER

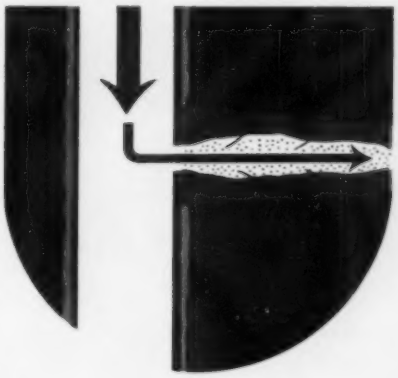
What happens to the fluid during a fracturing job?

As the fracture grows an increasing amount of fluid is lost through the extended surface. Fluid that would otherwise be available to enlarge the flow channel created for high flow capacity to the well bore.

When fluid is lost, power is lost, too!



HALLIBURTON'S LOW FLUID LOSS ADDITIVES



HELP EXTEND
AND ENLARGE FRACTURES

Additions of small amounts of these Low Fluid Loss Additives improve fracturing efficiency.

FL-1—A finely ground oil-soluble solid. Dissolves in production oil after treatment. Particularly good for fast production recovery.

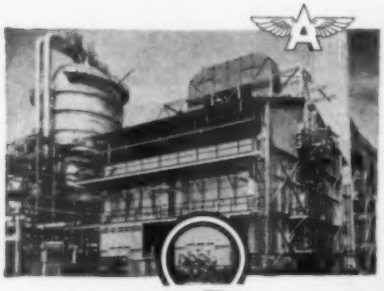
ADOMITE—An oil dispersible additive effective with most lease crudes and other water-free oil base fracturing fluids.

WLC-1—A finely ground solid for fluid loss control where fracturing fluids are fresh water, salt water or oil field brines.

Consult with your Halliburton representative.
Get the additive best suited for your well.

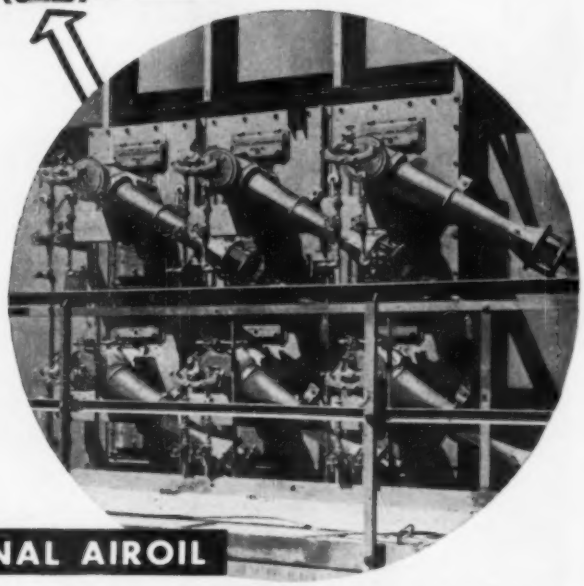
HALLIBURTON PIONEERS IN FRACTURING SERVICES

OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA • 251 SERVICE CENTERS — JUST MINUTES AWAY FROM ANY RIG



Firing

CRUDE DISTILLATION UNIT HAVING WORLD'S HIGHEST THRUPUT . . .



NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Looming large in the effort to meet increased products demand on the petroleum industry is Tidewater Oil Company's ultra-modern Delaware Refinery, for which C. F. Braun & Co. were the engineers and constructors.

We are proud that this mammoth 130,000 barrel-per-day crude oil Foster Wheeler Corporation heater is fired by NATIONAL AIROIL BURNERS . . . Why? . . . because NATIONAL AIROIL "Hi-Visk Airocool" Tandem Units are more than just combustion equipment. They are an *exclusive* Combustion System which has *proved* dependable in Petroleum Refineries throughout the world.

"Hi-Visk Airocool" Tandem Combustion Units (firing refinery gases, liquid asphalt, refinery fuel oils) hold heated combustion air within the high temperature zone until fuels and air are thoroughly mixed. This means that combustion takes place under the best conditions; the result: increased fuel efficiency with a minimum of excess air.

NATIONAL AIROIL Tandem Units provide extra flame travel *without adding to the furnace depth*, eliminating flame impingement on walls and tubes, extending the life of those elements; and because of this added flame length, the heat is more uniformly distributed.

The Tandem Unit is popularly fired with NATIONAL AIROIL Combination Oil and Gas Burners. YOU will realize higher profits from YOUR heaters when Tandem Combustion Units are specified. Further information sent upon request on your business letterhead.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

Main Office & Factory: **1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.**

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

SHOWCASE . . .

New Literature

Portable Industrial X-ray Equipment, said to provide the highest accuracy possible for radiographic inspection of castings, welds, and assemblies, and to facilitate improvements and repairs on metal products, is illustrated and described in this new two-color four-page folder. Three units are presented with respective kv. potential ranges of 55 to 200, 70 to 260, and 70 to 300. All have built-in high-tension transformers, simplified color - coded - technique charts on the face of the control panels, and protective devices for overloads, high voltage, and excessive oil temperature. Photographs show: (1) the units in actual use, (2) closeups of the X-ray tube and control units, (3) the hydraulic mobile crane assembly, and (4) the six accessories furnished with each unit. **Write or call: Mitchell Radiation Products Corp., 128 East Washington Street, Norristown, Pa., for folder on MS series X-ray equipment.**

●

Extending Cooling Tower Life is the subject of new Milton Roy Application Engineering Data Sheet D-57-1. The four-page data sheet describes several methods of combating corrosion and delignification in cooling towers using controlled volume pumps to meter precise qualities of chemicals to cooling water. It features complete details and drawings explaining: (1) continuous pH control, (2) acid metered in proportion to flow rate, (3) chemical feed with automatic level control, and (4) other cooling-tower water-treating systems. **Write or call: Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Pa., for Data Sheet D-57-1.**

●

Vinyl Coating that needs only two coats over a primer to exceed the customary film thickness of 5 mils is described in new Bulletin 33HB (two pages). According to the bulletin, the coating protects surfaces against alkalis, salts, sulfides, oils, alcohols, weather, and water. The dry film is said to be abrasion resistant, nonflammable, odorless, tasteless, and nontoxic. **Write or call: Amercoat Corp., South Gate, Calif., for Bulletin 33HB.**

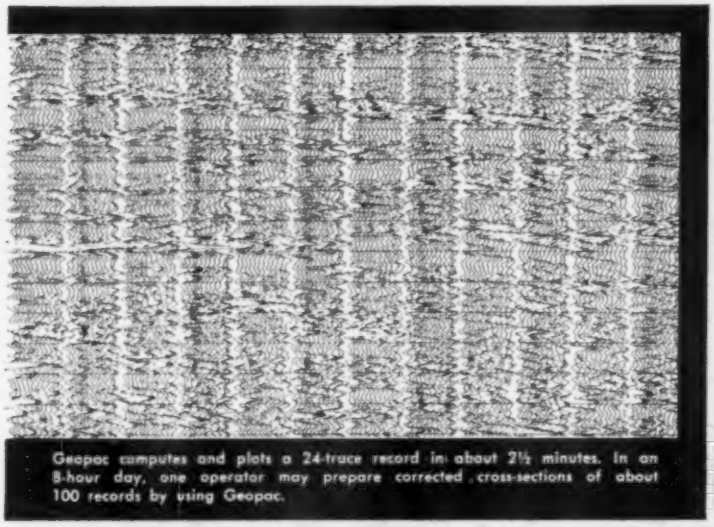
●

Superior Stationary Diesels, Models 60 and 80, are shown and described in new Bulletin 110. The literature lists the engines as designed to provide low-speed power for continuous, heavy-duty service. The engines are four-cycle, six or

GEOPAC

the fast, accurate, automatic seismic computor for economical data processing

Computer and Control Section — this section uses the regional velocity, distance, and elevation to compute a corrected time for each trace.



Geopac computes and plots a 24-trace record in about 2½ minutes. In an 8-hour day, one operator may prepare corrected cross-sections of about 100 records by using Geopac.

Magnetic Play Back Drum and Seismic Amplifiers — this section supplies the computor with the necessary basic information for making an individual correction to each trace.

Plotter Console — this section prints conventional timing lines simultaneously for each trace section plot. All plotted records are timed properly, regardless of variation of the position of time-break on the magnetic tape.

Geopac, the automatic plotter and computor developed by General Geophysical, offers a more efficient, a more economical way of processing and presenting seismic data. Geopac facilitates computation through improvement in speed, reduction of human error, the ability to handle and correlate large volumes of seismic data, and by presenting the results in simple organized cross section.

By presenting corrected data in a cross-section in which relative distances are preserved, the Geopac permits the seismologist to identify pinch-outs quickly, and helps to identify multiple reflections. It also aids in identifying geologic faults. This easy to operate unit does the "dogwork," frees the seismologist from many routine details, gives reduced unit cost. Geopac — truly a new concept in seismic interpretation.

General GEOPHYSICAL COMPANY

HOUSTON CLUB BUILDING • HOUSTON, TEXAS

General Geophysical Company de France (Int'l)
4 Square Rapp - Paris 7, France

General Geophysical Company de Venezuela, C. A.
Sociedad A. Campin No. 10 - Caracas, Venezuela

For additional information about the exclusive Geopac, write or call:

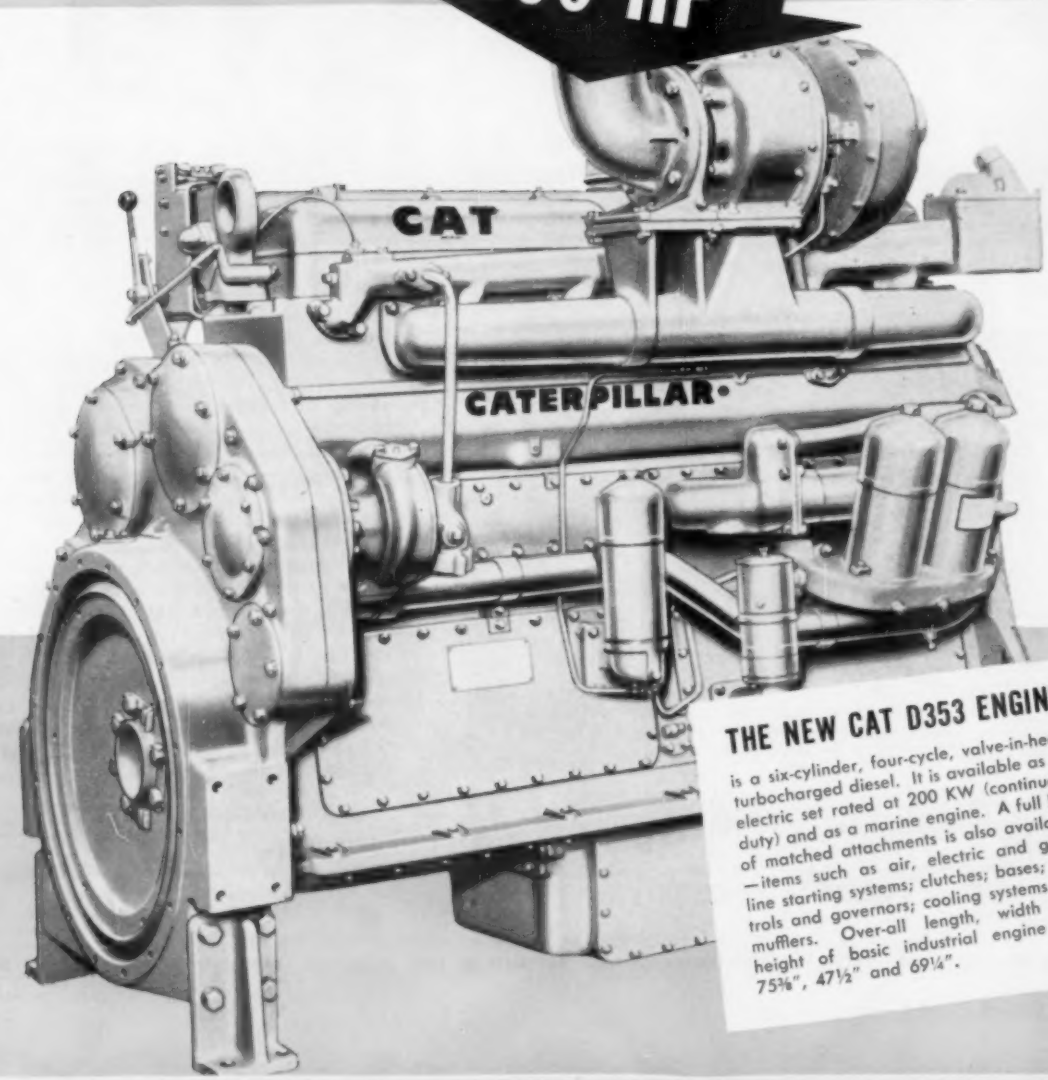
General Geophysical Company
Houston Club Building
Houston, Texas

WHEN YOUR CONTRACT IS WITH GENERAL, THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR

Caterpillar announces in the world's most

The engine that delivered outstanding is now available as the D353 Industrial

D397 650 HP† | D375 430 HP† | **New D353 390 HP†** | D342 225 HP† | D339 140 HP†



THE NEW CAT D353 ENGINE

is a six-cylinder, four-cycle, valve-in-head turbocharged diesel. It is available as an electric set rated at 200 KW (continuous duty) and as a marine engine. A full line of matched attachments is also available —items such as air, electric and gasoline starting systems; clutches; bases; controls and governors; cooling systems and mufflers. Over-all length, width and height of basic industrial engine are: 75⅜", 47½" and 69¼".

another heavy-duty engine advanced line of diesels

performance in the famous D9 Tractor Engine, Electric Set and Marine Engine

D337	D326	D318 (SERIES G)	D315 (SERIES G)	D318	D315	D311
310 HP†	200 HP†	175 HP†	115 HP†	137 HP†	91 HP†	65 HP†

†Maximum output capacity

Adding to Caterpillar's line of modern heavy-duty engines, there's now the Turbocharged D353 rated at 390 HP (maximum output capacity). This engine, a prototype of the unit in the mighty D9 Tractor, is job-proved after thousands of hours of operation in the field!

Like all modern CAT* Diesels, the D353 incorporates in its design the advanced features developed by Caterpillar in a quarter century of diesel leadership. Compact and sturdy, it is built for the hard work. Its four-cycle design delivers the long, effective power stroke that puts power to more efficient use than other types of engines. Its turbocharger utilizes waste energy from the engine exhaust to increase over-all efficiency and economy. Its fuel system requires no adjustment. There are no cylinder ports to clean. And its exclusive Caterpillar single-orifice injection valves, combined with the precombustion chambers, permit the use of a wide range of fuels including premium diesel fuels as well as low-cost No. 2 furnace oil *without fouling*. All these and other features add up to performance that no unit in its power class can match.

With the addition of the D353 to the Caterpillar Engine line, you now have a wider choice than ever for your requirements. Engines are available up to 650 HP (maximum output capacity) and electric sets up to 350 KW (continuous duty). Either as original or replacement power, there's one among hundreds of different arrangements that exactly meets your needs. Leading manufacturers of machinery can supply these models in the equipment they build.

For complete information about the new D353 and other Cat Diesels, see your Caterpillar Dealer. Let him show you how diesel leadership based on a quarter century of experience can engineer the modern, heavy-duty diesels of tomorrow.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

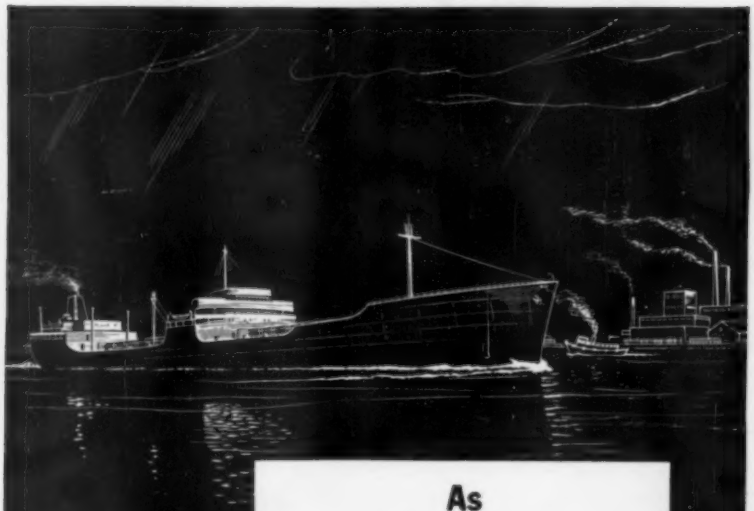
Caterpillar "Firsts" in a Quarter Century of Diesel Leadership

- "Hi-Electro" hardened cylinder liners
- Chemically conditioned cylinder liners
- Stainless-steel piston protectors
- Aluminum alloy bearings
- Interchangeable, adjustment-free fuel injection equipment
- Capsule-type injection valves
- Service meters
- Superior lubricants (detergent oils)
- Notarized, certified power

AND MANY MORE!

Certified Power for Cat Diesel Engines

Through the years, Caterpillar Engines have earned a reputation for *honestly rated power*. Now Caterpillar backs this reputation with a *notarized certificate* covering the horsepower capabilities of each engine. Caterpillar is the first and only manufacturer to give you this assurance of capacity. You have a right to demand *certified power* when you invest in an engine. You get it when you buy from your Caterpillar Dealer!



As
tanker capacity
grows...
FIRE HAZARD increases!

New, larger tankers
now help meet the nation's
needs for a greater flow
of liquid fuels.
But as tonnage grows,
so does fire hazard... both in
the ships themselves and
in the docks that serve them.
If the big new tankers
have a place in your business,
be sure
your fire protection program
is adequate.
For specific suggestions,
call National Foam.

NATIONAL FOAM System, Inc.
West Chester, Pa.

NATIONAL FOAM SYSTEM

The only company exclusively engaged in the design, development and manufacture of foam fire protection equipment and chemicals.

eight-cylinder in-line models, ranging from 530 to 2,000 b.hp., and from 300 to 1,250 kw. They are available either naturally aspirated or supercharged. And they can be furnished to run as diesel, dual-fuel, or gas engines. Both models have been successfully employed in oil-field pipeline and refinery service. The 12-page 2-color bulletin includes product photographs, illustrated construction features, dimension data, performance curves, and specifications. **Write or call: White Diesel Engine Div., White Motor Co., Springfield, Ohio, for Bulletin 110.**

•

Self-Adhering Markers for identifying pipe, conduit, and cables in chemical and oil-piping systems are detailed in this new catalog. The catalog outlines printed industrial markers, legends, and codes that reportedly give positive identification. Called Tel-A-Pipe, the self-adhering markers are furnished on easily handled dispenser cards for instant application. This is said to save hours of labor by eliminating messy painting and costly time consuming stenciling. Temperature ranges are from —300° to 300° F. The markers are available to conform to A.S.A. (Bulletin A-13), N.E.M.A. voltage schedule, and Military Spec. MIL-D 10369B. **Write or call: Westline Prod. Div., Western Lithograph Co., 680 East Second Street, Los Angeles, Calif., for catalog on pipe markers.**

•

Liquid Handling Equipment for the Petroleum Industry is explained in new Wheaton Catalog 65. It is a 10-page publication covering loading-arm assemblies, loading valves, swing joints, truck-tank equipment, storage-tank fittings, and miscellaneous products for the efficient handling of bulk liquids. The catalog contains specifications, diagrammatic views, and recommended applications on all standard company products. One section is devoted to general-engineering data of interest to engineers and designers. The informative brochure is expected to be particularly useful for installation technicians, operations engineers and purchasing staffs for specifying and ordering liquid-handling equipment. **Write or call: Wheaton Brass Works, Springfield Road, Union, N. J., for Catalog 65.**

•

Sealless Pumps are described in new and comprehensive eight-page Vanton Catalog 10.0. The catalog describes the Flex-i-liner line of sealless plastic and stainless-steel pumps. It contains both useful technical data and material-selection information. The pumps have

A jammed switchboard is bad business . . .

How long can you afford to let a busy superintendent, a lease agent or an important customer wait until your phone lines are open? Needless to say, delays and busy signals can cost you *plenty*, in the fast-moving oil business.

What you need is a P-A-X business telephone system—the privately-owned dial telephone system that is entirely independent of your present switchboard. P-A-X handles calls within your organization, frees the rented switchboard to handle outside calls swiftly and efficiently. Customers reach you quickly, the first time they call. Your own employees save precious time, because P-A-X provides immediate, private contact between persons in all departments. And, P-A-X soon pays for itself. There are no toll, mileage, or rental charges. You *own* your system.

Write for a case history of how P-A-X and Automatic Electric engineering are saving important money for a major oil company. Automatic Electric Sales Corporation, Northlake, Illinois. FIllmore 5-7111. *In Canada:* Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

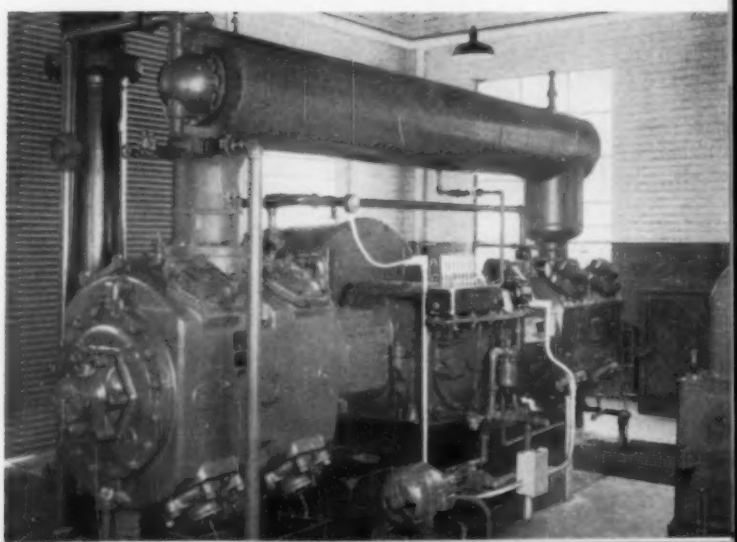
P-A-X telephone communications for the Petroleum Industry

AUTOMATIC ELECTRIC

A member of the General Telephone System
One of America's great communications systems

GENERAL SYSTEM

WITH COOPER exceptional



This two-cylinder Cooper-Bessemer air compressor, *with 5-step unloading, efficiently handles shop air requirements at Sohio's Toledo Refinery. Note the neat and compact appearance.*

AT Sohio's Toledo, Ohio refinery the compact 200 hp Cooper-Bessemer EM compressor shown here supplies shop air at an exceptional saving: a saving in space, in maintenance costs and over all operating expense.

Offering such important design advancements, such as natural force balance, these M-Line units deliver smooth performance without vibration. This installation is typical of the many important jobs being handled with dependable equipment furnished by Cooper-Bessemer.

Cooper-Bessemer packaged air compressors are available in four basic sizes from 200 to 6000 hp. Write today for complete information.

• BESSEMER...

dependability and compactness

BRANCH OFFICES: Grove City • New York • Chicago
Washington • San Francisco • Los Angeles • Houston • Dallas
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Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

ENGINES: GAS • DIESEL • GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL,
ENGINE OR MOTOR DRIVEN

COLD facts about a HOT subject . . .

Stewart Stoves

● Decide right now to replace make-shift heating facilities this winter with clean, safe, dependable Stewart Stoves.

Equipped with regular Stewart Hi-Efficiency B-4 gas burners—"The Burner without an equal"—Stewart Stoves provide plenty of heat at low cost, for derrick floors, warehouses, supply stores, garages, industrial plants, etc.

They are furnished for use with either natural, butane, propane or manufactured gas—furnished with or without vents.

Natural gas stoves furnished with gas valves, pilot light and pressure regulator. Butane stoves do not have pilot light and pressure regulator.

CONSTRUCTION: Bodies are heavy sheet steel. Rounded top, baffle plates and legs are cast iron. Finished with high temperature aluminum paint.

SIZE:

Model 15: 50,000 BTU, 35" high by 19" O.D.
Wt. 100 lbs.

When ordering, specify gas to be used.

U-11-56

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

no stuffing boxes, glands, or shaft seals through which damaging leakage or contamination can occur. Their features are clearly set forth in the catalog. The catalog also includes description of how the pumps work plus performance data, including pump-characteristic curves and charts with sizes, capacities, and operating-pressure ranges. A detailed materials-selections chart in the catalog indicates the recommended materials for more than 120 specific chemical solutions. The bulk of these data are said to be based on actual field results. **Write or call: Vanton Pump & Equipment Corp., 201 Sweetland Avenue, Hillside, N. J., for Catalog 10.0.**

●

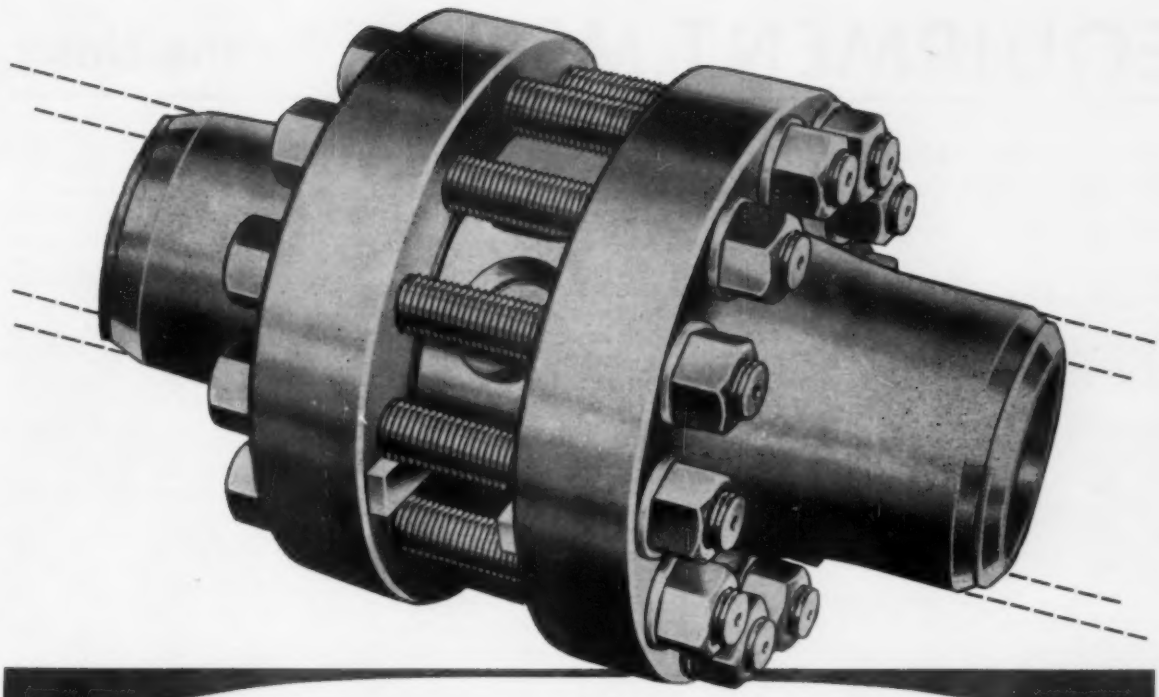
Molecular Sieve Brochure. Here's a new technical brochure that furnishes information on using molecular sieves as a drying agent for gases. Tables and charts provide engineering data for preliminary designs of low-dew-point drying systems. According to the brochure, the molecular sieves are adsorptive desiccants which offer unusually effective performance in commercial gas-drying operations. The brochure has 20 pages and is triple punched for loose-leaf book filing. **Write or call: Linde Co., 30 East Forty-second Street, New York 17, N. Y., for brochure on molecular sieves.**

●

A Case History in Cooling-Water Treatment to overcome corrosion and tower wood deterioration commonly found in recirculating cooling-water systems is given in six-page Betz Technical Paper 137. Devoted to a natural-gasoline plant in Louisiana, the paper discusses the problems and the program of treating water undertaken to both minimize the attack on the wood and to prevent corrosion. It goes into the effectiveness of the treating program and the corrosion studies made to evaluate the benefits of each step taken. **Write or call: Betz Laboratories, Inc., Gillingham & Worth Streets, Philadelphia 24, Pa., for Technical Paper 137.**

●

A Practical Data System for process industries is the subject of this new eight-page brochure devoted to the Beckman Model 112 data system. The brochure outlines the economics of automatic data processing in the present-day well instrumentated plant. It describes the application of systems to process-plant control and provision for future expansion. **Write or call: Beckman Instruments, Inc., 325 Muller Avenue, Anaheim, Calif., for brochure on Model 112 data processing system.**



Quickest Fix in Valves!

CHAPMAN 3-PIECE

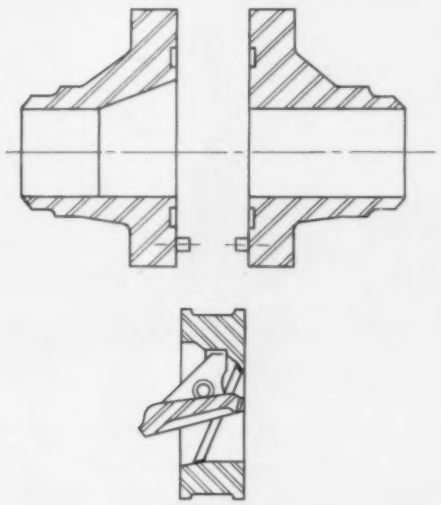
Tilting Disc Check Valve

When and if the time comes, it's as simple as this. You remove the studs between inlet and outlet section. You slip out the whole center . . . the working section . . . as a unit. You repair it or replace it and you have a valve as good as new in almost no time. It's the quickest, *lowest-cost* fix in valves.

Of course, with this 3-piece valve you get all the exclusive advantages of the Chapman 2-piece Tilting Disc Check Valve. You get fast, quiet operation. No flutter. No slamming. No banging. You get no scraping or wear and tear on disc or seat. You protect your whole valve system and keep your maintenance low.

If you don't have complete information on this and other Chapman Tilting Disc Check Valves, write for it, today. We'll get it into your hands, fast.

. . . just remove the center section



The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASS.

EQUIPMENT MEN . . . in the News

Avondale Names Alexander Manager of New Division

William B. Alexander has recently been appointed by Avondale Marine Ways, Inc., as manager of its new industrial contracts division. Alexander joined Avondale in 1956. Prior to his present appointment, he was with the engineering department at Avondale's main yard.

Avondale has formed this new division to consolidate all its facilities. The industrial contracts division will delegate work to the particular Avondale division best qualified to handle the job. Its base of operation is the service foundry division.

Continental-Emsco Makes D+B Personnel Changes

Continental-Emsco Co. has announced the following changes in D+B specialist personnel: Andrew J. Artzer, D+B specialist to be stationed at Kimball, Neb.; Thomas A. Mann, formerly located in Ardmore, Okla., to the Tulsa division office; David F. Barton, previously of Midland, Tex., to Ardmore.

Ernest C. Shoemate, newly appointed D+B specialist, will headquarter in Drumright, Okla. Don A. Davis has been appointed D+B specialist for the Houston branch store, and Donald M. Thorwart has transferred from Kimball to Newcastle, Wyo.

Weatherford Announces Promotions, Transfers

J. T. Liner, district manager for Weatherford Oil Tool Co. in Hobbs, N. M., has been promoted to assistant division manager of the eastern division with headquarters in Lafayette, La. C. W. Haston, sales and service engineer for Wotco at Odessa, has been boosted to district manager in the eastern division with headquarters in Houma, La. Lee Mooty, former sales and service engineer in the headquarters division at Houston, is now district manager in the western division and has been transferred to Wichita Falls.

Other transfers include: R. C. (Bob) Yates, former assistant division manager of the eastern division, Lafayette, La., to Oklahoma City as assistant division manager of the northern division; Gene Smith, former district manager at Wichita Falls to Hobbs in the same position; Gene Posey, sales and service engineer, from Abilene to Wichita Falls; H. J. (Bud) James, district manager at San Antonio, to Beaumont, Tex., in the same position; Byron Jay, sales and service engineer at Beaumont, reassigned to Corpus Christi; Willie Bourque reassigned to Lafayette from Harvey, La.; Bill delaHoussaye, transferred from Laurel, Miss., to Harvey.

New employes include Kenneth Wind and Sonny McCurry, sales and service engineers in the Houston area. Bill Williams has joined Wotco as co-pilot.

Netherlands Subsidiary of Reed Roller Bit Is Opened

Formal opening ceremonies of Reed Roller Bit Co. (Nederland) N. V., rock-bit manufacturing plant at Leiden, Holland, were held recently. Reed N. V., wholly owned subsidiary of Reed Roller Bit Co. of Houston, is this company's first oil-tool manufacturing expansion outside the United States.

R. G. Hamaker, president of Reed Roller Bit Co., was in Leiden for the ceremonies. F. L. Tyler, formerly California sales division manager for Reed, is the manager of Reed N. V., and John Workman, formerly an engineer for Reed in Houston, is comanager. Also taking part in the ceremonies were Dr. E. L. Kramer, director general for industrialization and power supply of the Netherlands Ministry of Economic Affairs, and F. H. Van Kinschot, burgomaster of the city of Leiden.

Cardwell Names Joyner as West Texas District Mgr.

C. P. JOYNER

The appointment of Carl P. Joyner as West Texas district manager for Cardwell Manufacturing Co., Wichita, Kans., has been announced by Clyde Lackey, domestic sales manager. Joyner will headquarter in Odessa, Tex. Joyner was formerly with White Motor Co. in Houston and Dallas as sales representative. He was co-owner of Wichita White Truck Sales Co. for the past 3 years.

Rolo Names Director of Sales, Adds to Sales Staff

James L. Kepple has been named as director of sales for Rolo Manufacturing Co. of Houston. He has been with Rolo 10 years and will continue to serve as secretary-treasurer of the corporation.

Additions to the sales and service staff include George Bradley, Ace Specialty Co., L. A. Christopher Co. and A. W. (Al) Swenson. Bradley is assigned to the Lafayette, La., area. The L. A. Christopher Co., with offices in Denver and Durango, Colo., will represent Rolo in the Rocky Mountain and Four Corners areas. L. A. Christopher and Steve Klimoski, both of the Christopher firm, have had considerable experience selling to the oil industry.

The Ace Specialty Co. now represents Rolo in the Abilene area under

the direct supervision of Rolo's West Texas representative, J. W. Massey, Jr., of Midland. Swenson will represent Rolo in North Texas and the Panhandle areas of Texas and Oklahoma.

Larkin Packer Names Two To Engineering Posts

JACK LARKIN

E. E. TEMPLE

Edward E. (Mike) Temple has been appointed as product development engineer by Larkin Packer Co., and Jack Larkin has joined the firm's engineering department.

Until recently, Temple was with Drilling & Exploration, Inc., as division manager in Brazil and Sicily. Also, he has held positions with Standard-Vacuum Oil Co. in Sumatra and with Shell Oil Co. in Texas. Temple will headquarter in Houston.

Larkin has been assigned to the general offices in Waxahachie, Tex.

Wyres Named Sales Manager Of W-S Fittings Division

James H. Wyres, former district manager for West Coast sales, has been named sales manager of the W-S Fittings Division of H. K. Porter Co., Inc:, according to Carl J. Siebert, Jr., general sales manager.

Wyres has been with the W-S Fittings Division 17 years. He started with W-S in 1940 in the machinery division, in 1948 was assigned to the New Jersey-New England territories and in 1952 transferred to Los Angeles where he headed West Coast sales until his new assignment.

Agent for Edward Valves Changes Company Name

Paul Bradfield & Co. is the new name of the Los Angeles manufacturers representatives firm formerly known as F. J. Hearty & Co. Coincidental with changing its name, the firm moved to new quarters.

The firm is widely known in southern California as sales representatives of Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co., and other manufacturers supplying equipment to the power, industrial and petroleum fields.

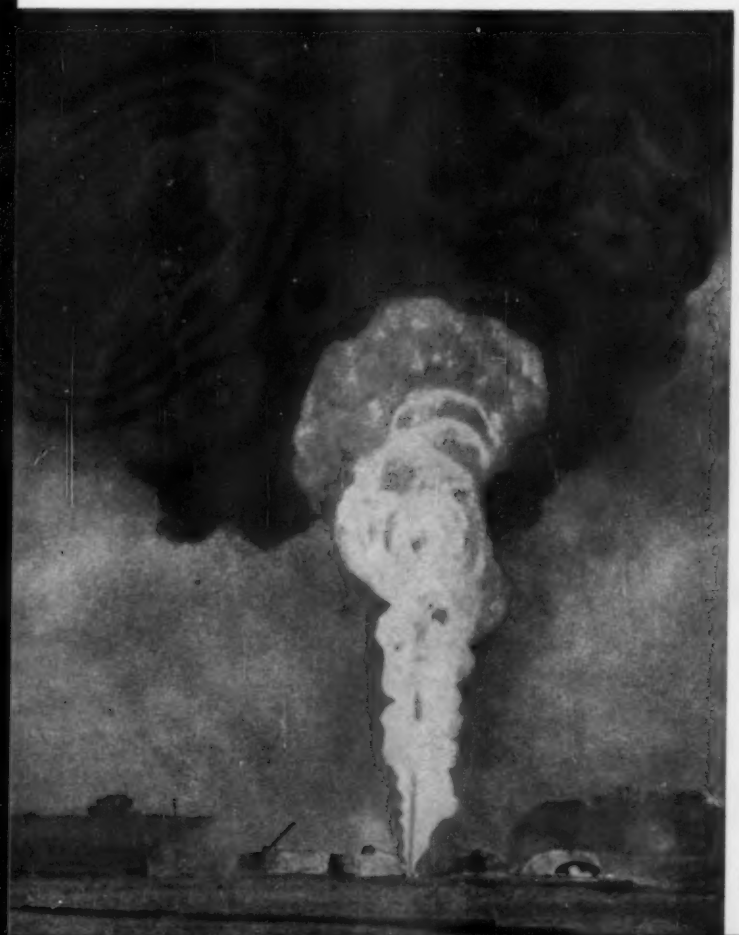
Paul Bradfield, manager of the Hearty firm for a number of years, is head of the new firm.

Borg-Warner Divisions Name Rose and Gregory

A. W. ROSE

J. N. GREGORY

Andrew W. Rose has been elected vice president and assistant to the president of the Byron Jackson Division of Borg-Warner Corp., according to E. S. Dulin, president of Byron Jackson. Rose is also a vice president of Borg-Warner. James N. Gregory succeeds Rose as vice president and general manager of the petrochemics research divi-



Sub-Surface Protection
Against Wild, Uncontrolled Flow

OTIS
TUBING
SAFETY
VALVES

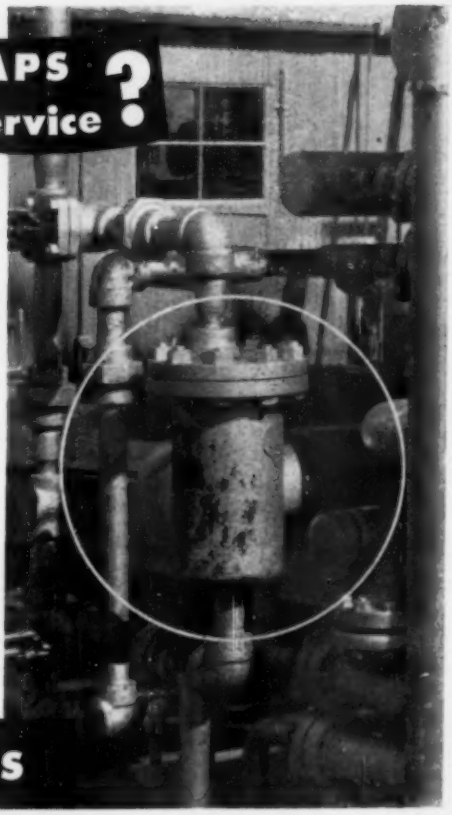
OTIS

OTIS/Branches Throughout the Oil Country

FORGED STEEL STEAM TRAPS for Low and Medium Pressure Service ?

YES!

Armstrongs Make Possible Economical All-Steel Installation To Withstand Fires and Explosions . . .



• MORE and more Armstrong Forged Steel Steam Traps are being used in the petroleum industry on steam pressures of 250 lbs. and less where fire and explosion hazards make iron fittings undesirable. The cost is not excessive, thanks to Armstrong mass production. You may be surprised at the relatively low cost of these traps . . . and once they are installed you can plan on using them almost *forever* without replacement and with very, very little maintenance over the years. They are available with screwed, socket weld or flanged connections for pipe sizes from ½" through 2"; for maximum pressures from 250 lbs. to 1500 lbs.; with capacities from 760 to 19000 lbs. condensate per hour at 250 lbs. pressure. Your nearby Armstrong representatives will give you complete information. Call him, or write:

ARMSTRONG MACHINE WORKS
8686 Maple Street
Three Rivers, Michigan

SEND FOR CATALOG . . .
44-page Steam Trap Book gives complete information on Armstrong cast and forged traps; includes selection, installation and maintenance data. Free on request.

ARMSTRONG STEAM TRAPS

OIL MEN CALL US 'BANKERS'. . . but BANKERS CALL US 'OIL MEN' ! ! !

You can talk the strange language of Oil with us because we "made up" some of the words! Fifteen of our directors are directly affiliated with the oil industry. We have one of the largest Oil Credit files in the nation; OIL LOAN service that includes oil-wise Trust Dept. counsel. See R. ELMO THOMPSON, R. OTIS McCLINTOCK, RUSSELL F. HUNT, WM. W. MICHAELS, BILL KENDALL or R. H. GWINNER. Remember, in Tulsa . . . in the Middle West . . . it's BOTH pleasant and profitable to . . .

Think 1st of Tulsa

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SINCE 1895

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VALLEY
LIGHTWEIGHT
STEEL PIPE

Manufactured in new, modern continuous mills to specifications per ASTM-A139 Grade B; which also conforms to API 5L standards. Automatic electric butt weld process, using submerged arc. Pressure tested. Ideal for use as line pipe for gas and oil, for municipal water systems and irrigation, high velocity tubing for air conditioning and heating, heat exchangers, well casing, grain and mineral spouting, as well as many other manufacturing and industrial uses.

Available in 6", 6⅝", 8", 8⅝", 10", 10¾" diameters, from 16 gauge up to and including .188 wall thickness; 20, 30 or 40-foot lengths; and in plain or belled ends. Quotations available for Victaulic or Dresser end processing, and coating.

Available for immediate delivery.

VALLEY **Manufacturing Company** Valley, Nebraska

Write or call for full specification and production data to: **Steel Pipe Division.**

sion of Borg-Warner. This division operates a laboratory at North Hollywood, Calif., where a sonic oil well drill in under development.

Prior to heading petromechanics operations, Rose was Pacific Coast representative for Borg-Warner. He has been a member of the supervisory board of Byron Jackson since the company merged with Borg-Warner in 1955. Rose has been with Borg-Warner since 1931. He began his career with the Warner gear division, becoming its vice president and assistant general manager. He also served as assistant to the chairman of Borg-Warner, Ltd.

Gregory served with Shell Oil Co. from 1936 to 1952. He became vice president and manager of field operations for Terminal Drilling & Production Co. in 1952. Since early 1957 he has operated as a consulting engineer in the field of mechanical engineering as applied to oil-field work.

Mission Employe Honored Upon Completing Degree

Dudley Sharp, left, assistant secretary of the Air Force for Material, congratulates Joe R. Burger, Mission Manufacturing Co. employe, following Burger's graduation from the University of Houston with a mechanical engineering degree. Burger has been employed in the design and drafting department at Mission for the past 6 years. He attended the university during this time. Sharp is the former president of Mission Manufacturing.

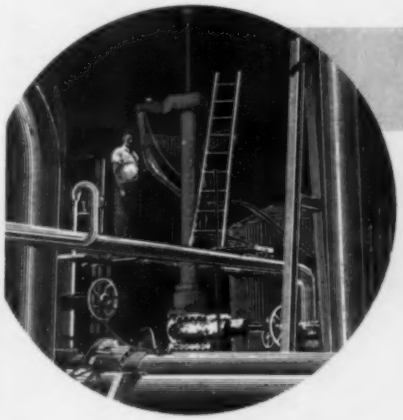
Curtiss-Wright Names Two To Utica-Bend Sales Posts

Harold C. Clark has been appointed general sales manager, diesel equipment, Curtiss-Wright Corp.'s Utica-Bend subsidiary. Francis E. Brylski has been named assistant to Clark.

Clark will direct the sales of the Mercedez-Benz diesel engine line, recently acquired by Curtiss-Wright. Brylski will assist in coordinating the sales and service activities on these engines which range from 19 to 3,000 hp.

Clark comes to Curtiss-Wright from the Findlay division of Gar Wood Industries where he was sales manager. He had several years' experience in the sales of heavy industrial equipment

They're also

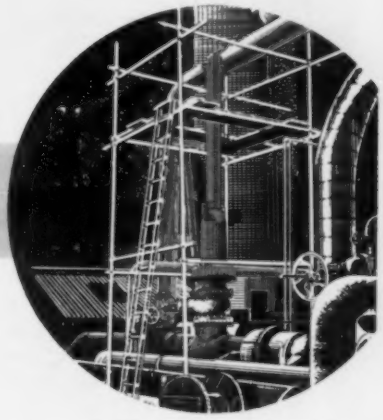


WMSON - HILLCO
TAPPING MACHINES

FOR CUTTING BRANCH OPENINGS INTO HIGH PRESSURE* OR HIGH TEMPERATURE PIPING
Without Shutdown

*All Machines tested to 2,175 p.s.i.

Big-Inch Tapping Operation



WMSON STOPPLE
plugging machines

FOR MAKING REPAIRS AND ADDITIONS TO PIPING WHILE FLOW CONTINUES THROUGH TEMPORARY BY-PASS

STOPPLE holding 400° F. steam

MACHINES IN STOCK FOR:
PIPE SIZES 3" TO 36"
STEEL OR CAST IRON, CONTAINING:

- OIL
- GAS
- STEAM
- GASOLINE
- WATER
- PROPANE

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REPRESENTATIVES: HOUSTON • AMARILLO • PITTSBURGH • PLAINFIELD, N.J. • JOLIET, ILL. • JACKSON, MICH. • LOS ANGELES • SAN FRANCISCO BARTLESVILLE, OKLAHOMA • SEATTLE • SALT LAKE CITY • EDMONTON TORONTO • WINNIPEG • VANCOUVER • BUENOS AIRES • CABIMAS, ZULIA, VENEZUELA • DURBAN, NATAL, S. AFRICA • PARIS, FRANCE • SIDNEY, AUST.

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Glitsch specializes in intricate tooling and fabricating of ferrous and non-ferrous materials . . . alloys and stainless steels. We design and fabricate kiln internals for cat-cracking units, reactor and regenerator beams and baffles, special piping, welding, steel components . . . in fact any equipment which must be expertly engineered for weight and strength ratios or special construction.

Whatever your requirements, you will find valuable experience and modern, complete fabricating facilities at Glitsch. And once we do a job for you, we know you will call us back because you will like the way our "Single Engineering Responsibility" complements your own production program. If you require any kind of specialty fabrication . . . for any process plant . . . call in Glitsch. Then you are assured of getting your job done right, and right on time. If you would like more information on Glitsch fabricating facilities, ask one of our representatives or write to us at P.O. Box 6227 in Dallas. There is no obligation, of course.

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Glitsch — for Special Units

with Buffalo-Springfield Roller Co. and Cleaver-Brooks Co. Brylski was previously with the Findlay division of Gar Wood Industries as assistant to the vice president in charge of sales.

Cooper-Bessemer Promotes Martin to Houston Post

Earl P. Martin has been promoted to assistant branch manager of the Houston office, according to Grant C. Woodard, general sales manager of Cooper-Bessemer Corp.

In his new position, Martin will work under the supervision of R. H. Dale, branch manager, and will assist directly in the management of the Houston office and warehouse facilities.

Martin was with Foxboro Co. and Rockwell Manufacturing Co. before coming to Cooper-Bessemer in 1939.

Baash-Ross Names Sales Manager for Permian Basin

Harold Whitely has been appointed Permian basin area sales manager for Baash - Ross Tool Co., division of Joy Manufacturing Co., according to H. L. Messinger, Baash-Ross general sales manager.

H. WHITELY

Whitely has been with the company since 1953 as a field representative in the Odessa area and will continue to headquarter there.

Chempump Names Three New Sales Representatives

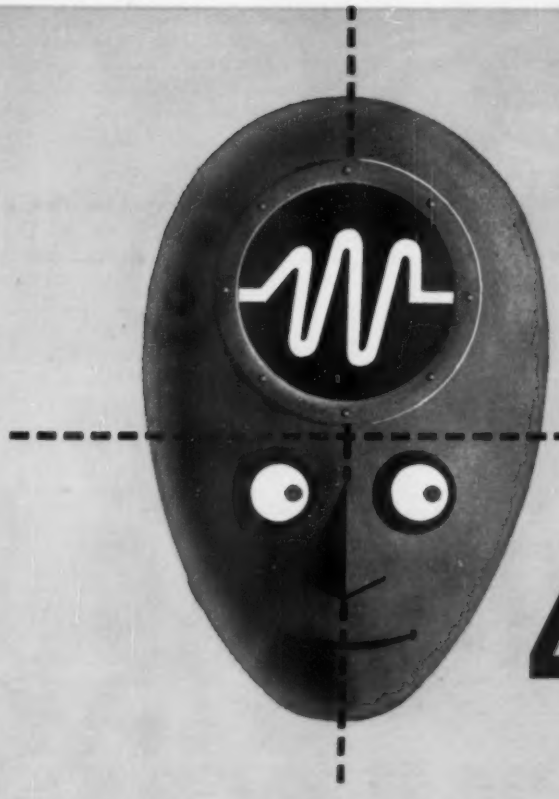
Three new sales agents have recently been appointed by Chempump Corp., Philadelphia. The company has also expanded the territory of its Cleveland representative.

Chemical Pump & Equipment Corp. of Chicago now handles sales and engineering service for Chempump in the northern Illinois, northwestern Indiana and Chicago area. H. L. (Red) Laitner is in charge of this office.

Tate Engineering, Inc. has been appointed to handle Chempump sales and service in Virginia. Home office of Tate is in Baltimore, and Virginia sales activities are based in Richmond and Roanoke.

Process Sales Co., Beaumont, Tex., now promotes Chempump sales and service in the Texas Gulf Coast region. L. P. (Bud) Skinner covers plants from Brownsville to Port Arthur for Chempump.

Chemical Pump & Equipment Corp., Cleveland, has been assigned to cover



THE E-I-M

FUTRONIC

VALVE CONTROL

masterminds

48,000

barrels a day,

For complete details of the FUTRONIC valve control write

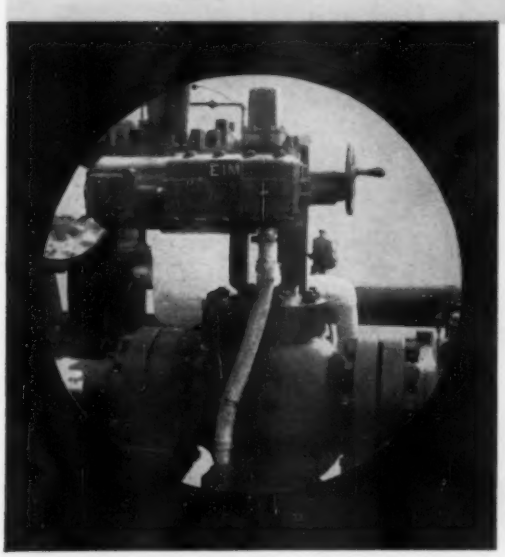
E-I-M

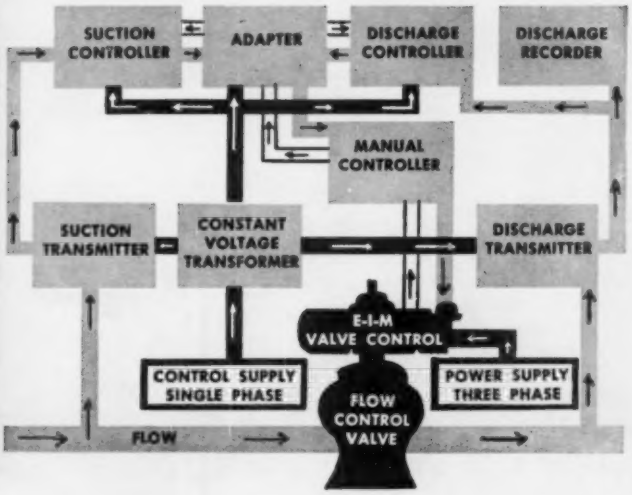
COMPANY, INCORPORATED
1340 Old Spanish Trail
Houston 25, Texas

The FUTRONIC regulates this crude oil output at a fully automatic, completely unattended pumping station in Southern Oklahoma.

The FUTRONIC valve control system, is particularly valuable in meeting pipe line compressor station, pipe line pumping station and metering station requirements.

Units are adaptable for readout, cascading, computer and similar systems. Transmission distances of great length are permissible and it is possible to tie in with leased wire, micro-wave and other metering systems.

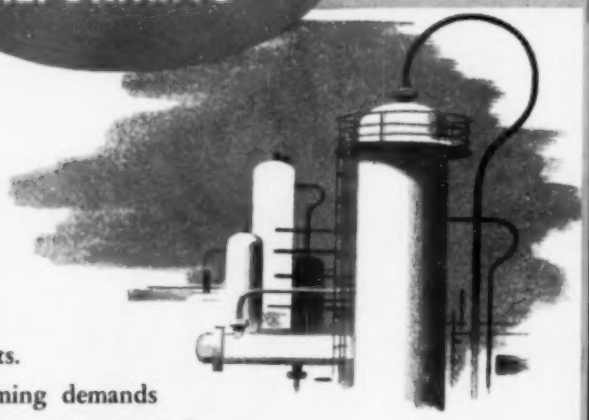




Accuracy...

is TRADITIONAL at WESTERN

Accuracy
IS VITAL TO
CATALYTIC
REFORMING



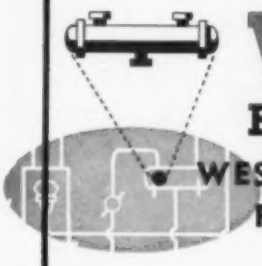
Many of our customers employ a catalytic reforming process in the production of premium motor fuels, high yields of aromatic hydrocarbons, or high-quality aviation gasoline components.

Whatever its application, catalytic reforming demands *unerring accuracy* in the heat transfer equipment employed—accuracy in rating—in design—in welding—in complete fabrication.

Western Heat Exchangers meet these demands because Western's rating and design engineering—manufacturing techniques—close attention to detail—are dedicated to *accuracy first.*

Western has successfully participated in the development of many catalytic reforming units now in service throughout the world.

Western's representatives stand ready to serve you . . .



WESTERN
HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P.O. Box 1888 – Tulsa, Oklahoma

the southern Ohio area in addition to the northern portion of the state. Paul Flucke, Hal Zanders and Bill Merrill all go into the Cincinnati area at present, but it is expected that an office will be opened there soon.

Crouse-Hinds Promotes Clarke and Northup

Albert H. Clarke, former vice president for engineering, has been named vice president of manufacturing for Crouse-Hinds Co., Syracuse, N. Y., according to John R. Tuttle, chairman of the board and president. Clarke's successor as vice president for engineering is Russell P. Northup, formerly commercial vice president for Condulet sales, who will supervise the company's product research and development programs.

John B. Crosby has been named assistant to the president to succeed Northup as Condulet sales manager, and William A. McAuley is new products manager in the sales division.

Clarke joined Crouse-Hinds in 1925 and became commercial vice president in 1952. Northup is a 22-year veteran of the company's sales division.

Christensen Names Maltbie, Haught as District Managers

LLOYD MALTBIE

PETER HAUGHT

Lloyd Maltbie has been appointed district manager of the Hobbs, N. M., area of Christensen Diamond Products Co. Peter Haught, field engineer in Amarillo, Tex., has been promoted to manager of the newly formed Amarillo district, with suboffices in Liberal, Kans., and Pampa, Tex.

Maltbie has been working in Great Bend, Kans., as field engineer. In his new position he will be in charge of all sales promotion in the southern New Mexico and West Texas area. Both Maltbie and Haught have been with Christensen Diamond Products over 5 years.

Parker-Fallis to Install Johns-Manville Insulation

The industrial insulation division of Johns-Manville has named Parker-Fallis Insulation Co., Inc., as its in-

• CORROSION RESISTANT LINE
• 20 Ounce BRASS PLUMB BOB
• 50% HEAVIER LINE

LUFKIN

EASY TO READ MARKINGS THAT ARE DURABLE

"ATLAS" CHROME CLAD
OIL GAGING TAPE

Atlas lines are 50% heavier than standard weight steel tapes. Full 20-ounce solid brass plumb bob penetrates heavy oils. Easy to read. Bold black markings contrast with exclusive "glare-free" Chrome Clad surface — oil level shows clearly. Multiple platings prevent rust and corrosion. Wipes clean. Lines are replaceable. Lengths from 18 to 100 feet.

BUY LUFKIN TAPES • RULES PRECISION TOOLS FROM YOUR SUPPLY HOUSE

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BETTER MEASURE WITH LUFKIN

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› all types of
REFINERY VESSELS
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MASTER TANK & WELDING

FITTED FOR THE JOB

Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER *FIRST* for the finest in steel fabrication.

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Master also produces API 5LX HI-TEST Expanded Line Pipe

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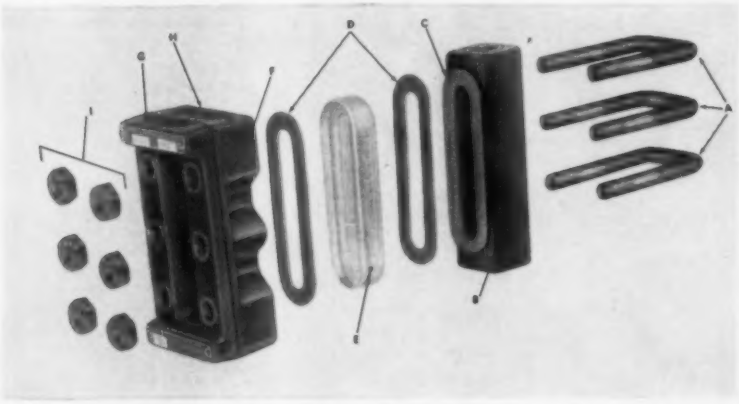
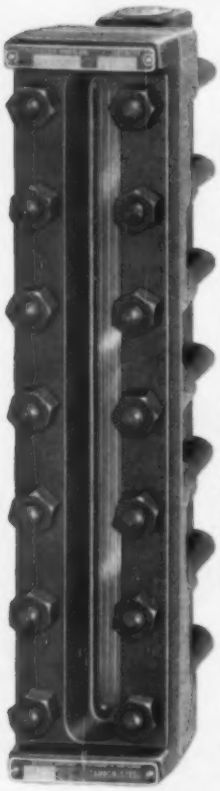
Penberthy Gages give you EXTRA FEATURES AT NO EXTRA COST

CLEAR, ACCURATE LIQUID-LEVEL READINGS
in all tanks, boilers, vessels, containers, flow lines.



PENBERTHY REFLEX GAGES TYPE V & S



A Alloy Steel Bolts for high temperature service.
B Alloy Steel Liquid Chamber heat treated . . . no warping.
C Raised Face on Liquid Chamber insures perfect self-alignment of frame with glass and gasket.
D Composition Gaskets and Cushions are interchangeable.
E Resilient Band around glass centralizes it at assembly.
F Drop Forged Steel Frame extra heavy and rigid.
G Extra heavy beam at end of Frame (prevents distortion).
H Frame overlaps liquid chamber at all points.
I Alloy Steel accurately threaded nuts.

The "inside story" of Penberthy Liquid Level Gage construction shows why you get positive-accurate readings at temperatures from sub-zero to over 1000° F; up to pressures exceeding 10,000 psi.

Exclusive features assure long service (at no extra cost) in all types of applications . . . even with highly corrosive and dangerous chemicals. Maintenance is much simpler; replacements and repairs made without removing assembly from vessel.

Proved through extensive use, Penberthy gage sets are available, in bronze, iron, carbon steel, stainless, monel and other materials . . . from stock or specially designed by gage engineering specialists.

Catalog 36 details complete line including accessories. Please send request on business letterhead. No obligation, of course. Order through your jobber or direct.

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Division of Buffalo-Eclipse Corporation
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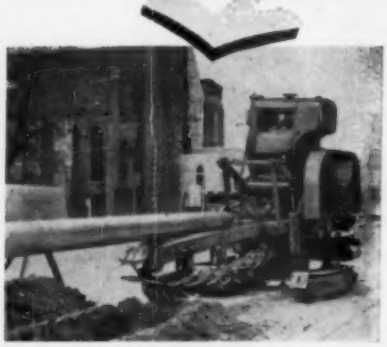
PRODUCTS BY PENBERTHY

- GAGES
- EJECTORS
- EDUCTORS
- SYPHONS
- ELECTRIC SUMP PUMPS
- CYCLING JET PUMPS
- INJECTORS
- EXHAUSTERS

DIG MORE DIRT FOR LESS MONEY WITH A Pow-R-Ditcher



Model 4T Pow-R-Ditcher

Here's a real workhorse that digs for LESS because it costs so much LESS! Ideal for the light construction field in laying gas pipe, water and cable lines and digging home foundation footings. Very maneuverable for those "tight spots", the 4T is only 6' high, 13' long and 48" wide. Digs 6" to 14" wide and up to 17' per minute. Handles most small ditching jobs at a fraction of the cost of more expensive ditching machinery.

"Small W-2 Pow-R-Ditcher is Finest for Small Services"

. . . says Post and Lee Service of Alta, Iowa. "In one month we completed over 100 services (7100 feet). It was rugged work but the W-2 handled it with no breakdowns except a pair of belts. We keep ahead of schedule with the W-2." The W-2 digs 2½" to 4" wide and is ideal for gas service, electrical service and shallow water lines.

Write For Literature and Low Prices on the Complete Vermeer Pow-R-Ditcher Line

Larger Pow-R-Ditcher models also available. Check the performance, quality and price before you buy. Our nearby Vermeer dealer will be happy to arrange a demonstration.

VERMEER MANUFACTURING CO.
1447 W. WASHINGTON • PELLA, IOWA

sulation contract unit in both the North Central and South Central portions of Texas.

In the North Central section, which includes the Dallas-Fort Worth area, Parker-Fallis will maintain an office and warehouse at Dallas. The South Central area will be covered by an office and warehouse at San Antonio. The San Antonio location will also cover the cities of Austin and Temple.

President of Parker-Fallis is E. H. Parker; vice president is George R. Crowdus. The company's San Antonio office is managed by J. T. Lusk.

The contract unit will be backed by Johns-Manville engineering and sales staffs under the direction of R. A. Stapleton, Johns-Manville area sales manager, Houston.

Welex Names Underwood as Farmington Sales Engineer

S. UNDERWOOD

Shelby Underwood has recently been promoted to sales engineer for the Farmington district of Welex Jet Services, Inc., according to J. B. Vaughan, vice president of sales for the Fort Worth oil well supply company. Shelby has been in oil well service work for 12 years serving as rigman and shooter before becoming a salesman.

Bauer, Mischke, Dietz Named to New A-C Division

Formation of Allis-Chalmers International as a major operating division of Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has been announced by R. S. Stevenson, president of the company.

P. F. Bauer, until now general manager of the industrial equipment division, is appointed managing director of the new division. Floyd J. Mischke, who has been tractor group export manager, and Paul Dietz, industries group export manager, are appointed associate directors of sales of Allis-Chalmers International. The new division will be responsible for all manufacturing, engineering, and sales operations and activities outside the United States and Canada.

Bauer joined Allis-Chalmers as a salesman in the Pittsburgh district sales office in 1928. He served as manager of industrial sales, industries group; manager of the group's Central region; and general manager of the Norwood, Ohio, Works. Mischke joined the industrial sales department of Allis-

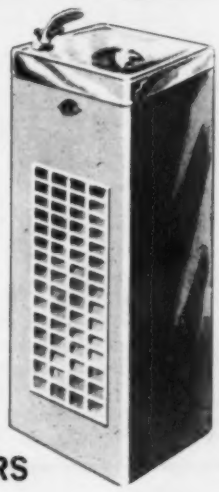
MEMO: to PAs

the products you buy will look better, last longer

with CrysCoat®

under the paint

CALCULATORS



...TO COOLERS

You're getting a better piece of equipment if it carries Oakite CrysCoat protection. It means the product has been given a paint-bonding phosphate coating before painting by the quality-conscious manufacturer. This is important to you because it means that the product is protected against the spread of rust and the peeling of paint should the finish become accidentally damaged.

Next time you purchase fans, desks, water coolers, steel lockers, lighting fixtures and similar painted equipment, investigate those with CrysCoat protection. They'll look better, last longer. For the CrysCoat story write Oakite Products, Inc., 44C Rector Street, New York 6, N. Y.

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OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

CrysCoat *paint-bonding treatment*
makes products look better . . . last longer

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

IF YOU'RE HANDLING CORROSIVE FLUIDS...

K DUCTILE IRON FITTINGS ARE A MUST!

A nationally known chemical manufacturer reports that Kuhns ductile iron pipe fittings lasted six times longer in raw water lines than ordinary fittings. The brackish water at 80° C. contains 100-2000 parts chloride per million.

They also report excellent results with flanged ductile iron fittings on pumps operating up to 200° C. Other uses reported for Kuhns "DI" fittings include handling oleum at 40° C. to 100° C., steam at 125 psi, steam condensate, nitrogen at 175 psi, carbon dioxide at 150 psi, propane, ammonia, isobutylene, isobutane, and all weak acids.

SAFETY FACTOR

The smooth walls of Kuhns ductile iron fittings, their basic resistance to corrosion, high yield strength of 45,000 psi and excellent thermal shock resistance mean greater plant safety and lower maintenance costs wherever corrosion or volatile fluids are handled.

LISTED BY UNDERWRITERS' LABORATORIES, INC.

"K" Flanges and Flanged Fittings

Elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Pressure rating, 500 psi by Underwriters' Laboratories, Inc. Flat faced flanges shipped as standard. Extra heavy flange dimensions and raised faces available on request. Look for the "DI 500" on each. Complete range of sizes through 12".

NOTE: These fittings are excellent for liquefied petroleum gas systems. Look for the "DI 300" on each.

"K" Screwed Fittings*

Pressure ratings listed by Underwriters' Laboratories, Inc.

STEAM AND OIL AT 550° F.
¼" to 3" ..... 300 lbs.

LIQUID AND GAS AT 150° F.
¼" to 1" .....2000 lbs.
1¼" to 2" .....1500 lbs.
2½" to 3" .....1000 lbs.

*Ductile iron fittings are available in any size in Kuhns' complete cast iron line, ¼" through 12".

From the melt in modern electric furnace through to critical inspection, these fittings are made in accordance with A.S.T.M. specifications A-339-55, A-395-55T to provide nodular structure and highest quality to meet industry's strictest requirements.

"K" fittings are available nationally through better wholesalers.

K THE KUHNS BROTHERS CO.

1800 McCall Street • Dayton, Ohio

1887—70 Years of Continuous Progress—1957

Chalmers tractor group in 1933 and later served as factory representative to Latin American countries and assistant export manager of the tractor group.

Dietz has been export manager for Allis-Chalmers industries group since 1943.

Robert B. Allen Named Vice President of McNamar

R. B. ALLEN

Robert B. Allen has been appointed vice president of McNamar Boiler & Tank Co., Tulsa, according to James Jackson, president. Allen was associated with Southern Aircraft Co., Squibb-Taylor Co. and Gas Equipment Co. prior to his appointment as vice president of McNamar.

Baroid Names MacDiarmid, Jones to New Posts

MacDIARMID

R. G. JONES

Douglas W. MacDiarmid has been appointed Louisiana sales representative for Baroid Division of National Lead Co., Houston. MacDiarmid, formerly district manager at Harvey, La., will be located at Lafayette.

Richard G. Jones, formerly field sales representative at Houma, La., has been appointed district manager at Harvey to replace MacDiarmid.

G & H Towing Co. Opens Offices in New Orleans

G & H Towing Co. opened offices in New Orleans recently, it has been announced by Capt. John G. Leech, director of marine operations.

According to Cecil R. Haden, G & H president, the New Orleans office, located in the Delta Building, will coordinate the company's services which are now available at Morgan City, La., and which will soon be available from near Venice, La., where docking facilities for the company are now under construction.

Headquartered in Galveston, Tex.,

and operating also from the ports of Houston, Corpus Christi and Freeport, Tex., the company's new facilities in Louisiana will make possible prompt tug service to the oil industry along the Louisiana-Texas tidelands.

G & H operates a fleet of 31 completely equipped diesel tugs, ranging from 700 to 1,700 hp. J. Newton Rayzor is G & H board chairman, and Capt. H. O. Weatherbee is executive vice president of the company.

Murray-Brooks Appoints Mid-Continent Sales Mgr.

E. L. COULTER

Earl L. Coulter has been appointed as sales manager of Murray-Brooks, Inc.'s Mid-Continent district, according to Jack R. Wright, vice president of Murray-Brooks, Houston. The Tulsa office will be located in the Mid-Continent Building.

Coulter has been in the oil field supply business in Tulsa for the past 12 years.

The company is engaged in the distribution of tubular goods, equipment and supplies for the oil industry. Murray-Brooks was organized in Lake Charles, La., in 1883, where the firm has its general office and base warehouse unit.

J&L Enlarges Tulsa Operations, Names Wood

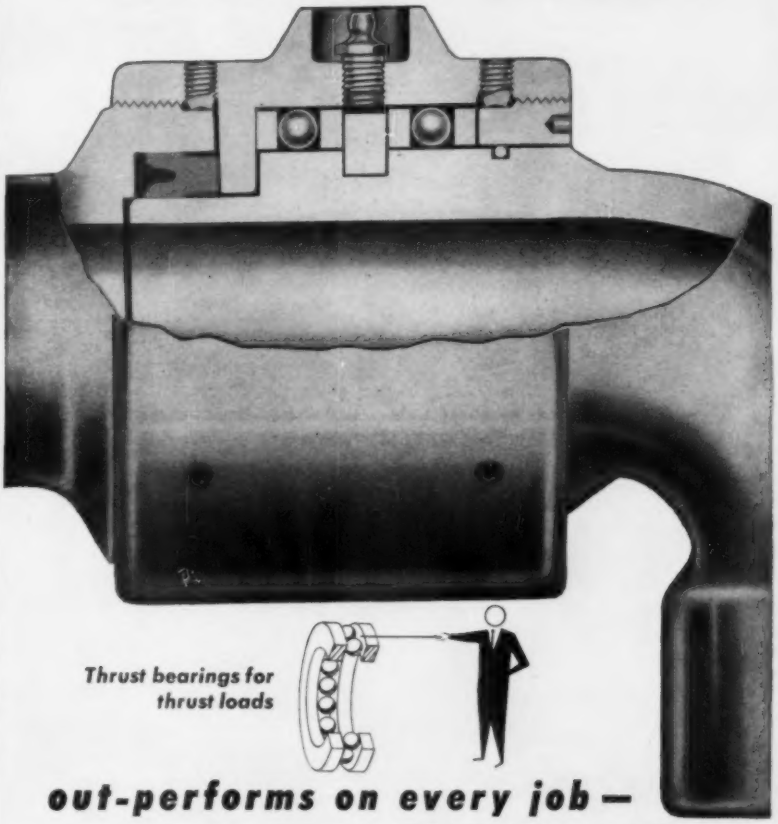
BILL WOOD

Jones & Laughlin Supply Division will enlarge its Tulsa city sales office operations and has appointed Bill Wood as manager, according to W. L. Wolfe, vice president of sales. Bill Wood joined J&L at Natchez, Miss., as a sales representative in 1952. In 1955 he was transferred to the firm's New Orleans office and in 1956 was promoted to assistant district sales manager of the North Texas district with headquarters at Wichita Falls, Tex.

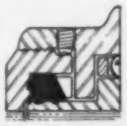
Atkins, Kroll Named BJ Philippine Representative

Atkins, Kroll & Co. has been appointed sales representative for Byron Jackson Tools, Inc., in the Philippines, according to Garth Nicolson, vice pres-

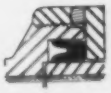
FINEST SWIVEL JOINT ON THE MARKET TODAY



out-performs on every job — yet costs no more



Grooved packing for high temperatures or corrosive services.



Lip type packing for high pressures.

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Compare Continental-Emsco ball race design — thrust bearings for thrust loads. Compare the method of sealing against leakage — an isolated packing chamber in which is retained the type of packing most suited to the job. Joint breaks like a union for easy inspection or replacement of packing.

You profit directly from these features — the result of years of engineering know-how built into every Continental-Emsco joint. If you're not already using Continental-Emsco, better send today for latest catalog and prices.

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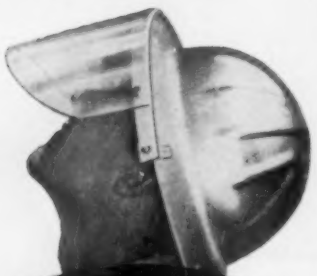

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ident and general manager of Byron Jackson Tools, Inc., and Earl Rees, export manager of the same company.

Atkins, Kroll will handle the full line of BJ tools, including hooks, tongs, slips, spiders, power tools, rubber goods and other drilling equipment.

Southwestern Plastic Pipe Names Director of Sales

Charles B. Turner has been appointed director of sales for Southwestern Plastic Pipe Co., Mineral Wells, Tex. He was formerly sales manager of the wholesale division.

In his new post, Turner will head distribution through two sales divisions, the industrial division with A. J. Brumbaugh as sales manager, and the wholesale dvision with Harry A. Riley, Jr., as sales manager. Both divisions will market five basic types of plastic pipe.

Henry H. Paris Elects Brawner as Vice President

Charlie A. Brawner, who has been with Henry H. Paris Distributor, Inc., since 1951, has been elected vice president of the corporation. Starting as sales manager, Brawner was named assistant to the executive vice president in 1952, which position he has held until his recent appointment. He will continue as director of sales, in addition to his new duties as vice president.

Brawner has more than 20 years sales experience in the oil industry supply business. He was with Dunigan Tool & Supply Co. 14 years prior to joining Henry Paris.

Minneapolis-Honeywell Names Four to Sales Posts

E. J. Byrne has been appointed as petroleum industry manager for the industrial division of Minneapolis-Honeywell Regulator Co., according to J. A. Robinson, field sales manager. K. R. Knoblauch, who joined Honeywell in 1924, will devote full time to duties as chemical industry manager on a national basis. He formerly was metals processing industry manager.

Two new industrial managers have been named for the Dallas and Houston offices. At Dallas, Paul R. Sharadin succeeds Robert Harris, who becomes district manager at Tulsa. C. D. Walker succeeds Byrne at Houston.

Byrne joined Honeywell in 1947 as

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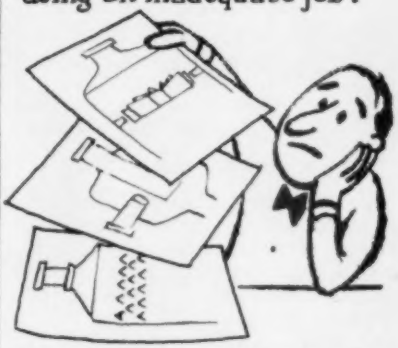

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Offers reliable testing with the same speed, safety, and economy as other wire line logging services.

Formation tests are obtained with this tool when hole conditions prevent the use of other testing methods.

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The tool is set exactly at the level to be tested by correlation with the S.P. curve. This, combined with the fact that only a limited vertical section is tested, allows selectivity never before possible . . . oil/water or gas/oil contacts can be easily defined.

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It's practical — The tool is run on Schlumberger cable anytime during drilling and at any level in the hole. This means economical testing.

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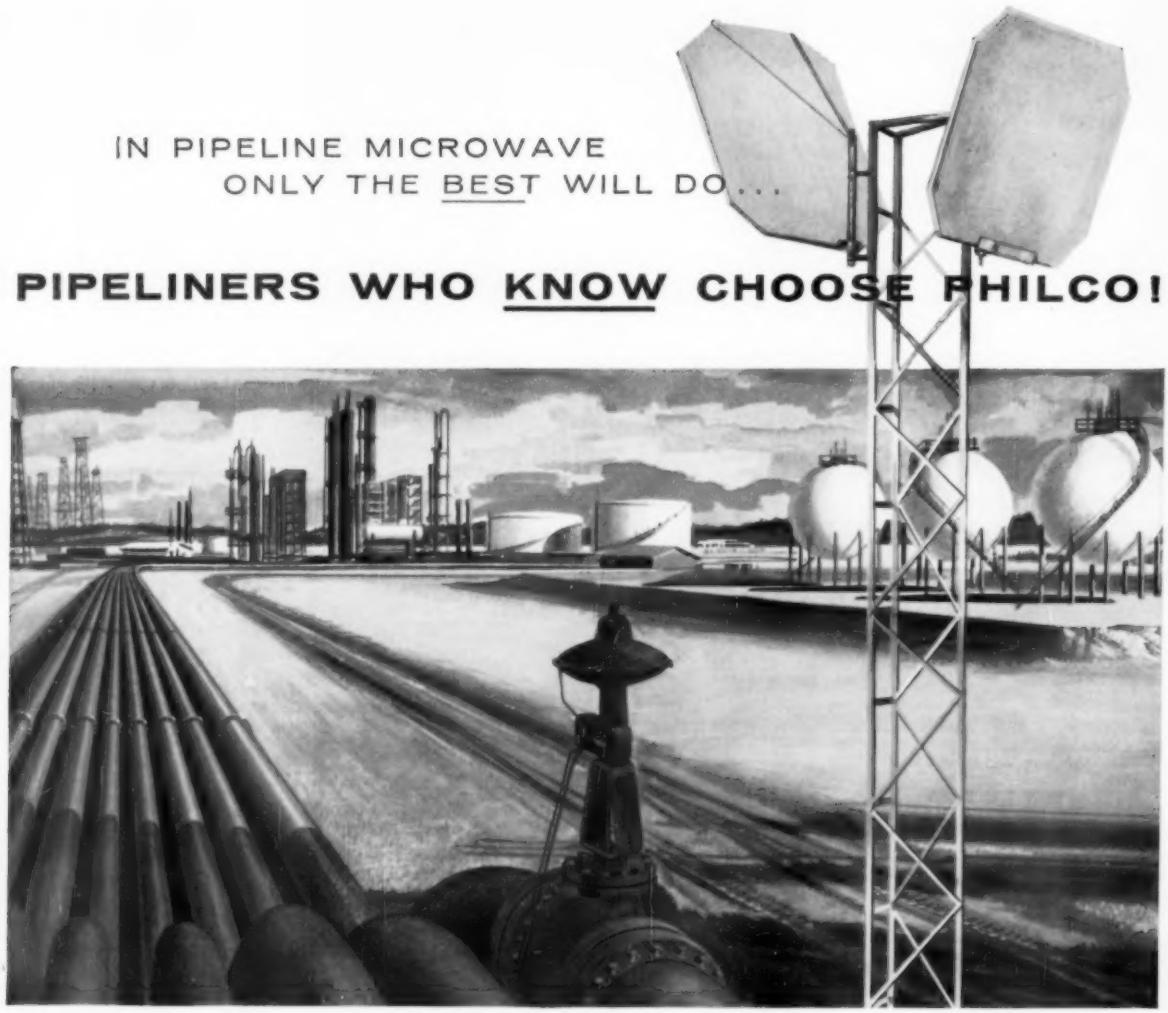

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an industrial instruments salesman in Houston. Hs subsequently was industrial sales manager in the Dallas office and for the last 4 years served in the same capacity in Houston. Walker joined Honeywell in 1948, Sharadin in 1951.

Dresser Names Turbodrill Manager of Operations

M. T. WORKS

Madden T. Works has been appointed to the post of manager of operations, according to Ott Hammer, general manager of Dresser Industries, Inc.'s turbodrill division. Works will be in charge of development engineering, the manufacturing department, and the field service department of the new Dresser Industries division. He will be located at the Dallas headquarters of the turbodrill division.

Prior to appointment to this position, Works was president of Pioneer Specialties, Inc., Houston, a manufacturer of oil-field equipment. Previously, Works was employed by Cameron Iron Works of Houston as sales manager and as chief engineer.

Owens Named St. Paul Manager for Trane Co.

Robert H. Owens has been named manager of The Trane Co. sales office in St. Paul, Minn., according to Trane Vice President A. C. Menke. Owens had been with the Trane Cleveland office during the past several years.

GE Names R. L. Grunewald To Gas Turbine Post

Robert L. Grunewald has been appointed manager - manufacturing for General Electric Co.'s gas turbine department, according to John P. Keller, department general manager.

Grunewald joined General Electric in 1936. From 1943 to 1945 he was a technical engineer at the Lynn River Works. He later was a member of the advanced manufacturing -program in Fort Wayne and Lynn, and in 1947 he transferred to the company's jet engine production organization, serving in Everett, Mass., and Evendale, Ohio. In 1955 Grunewald was named manager-component manufacturing and engine rebuild, production engine department, at Evendale, retaining this position until his present appointment.

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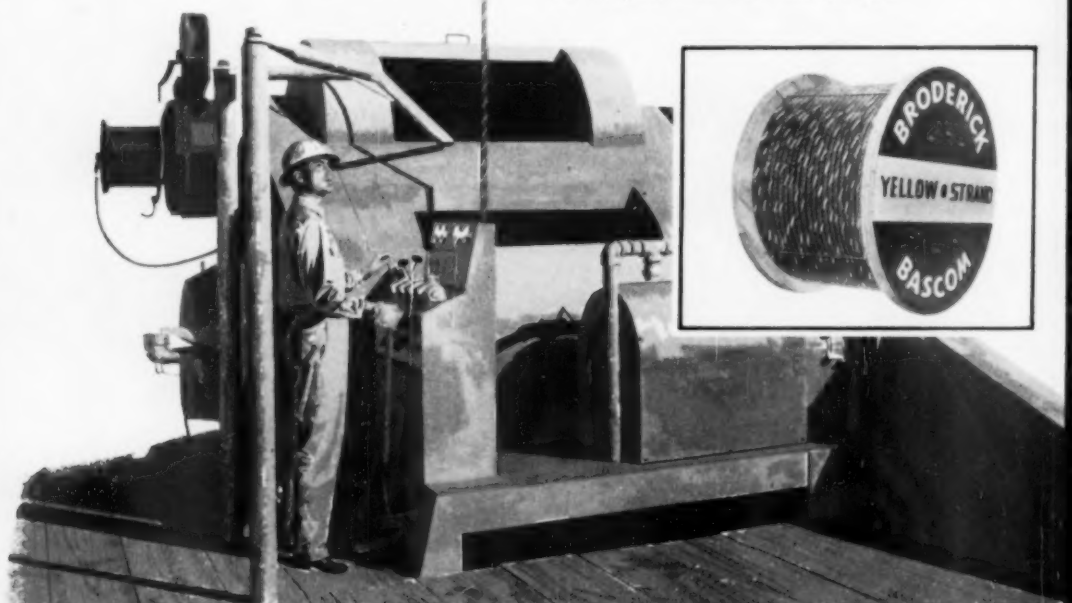

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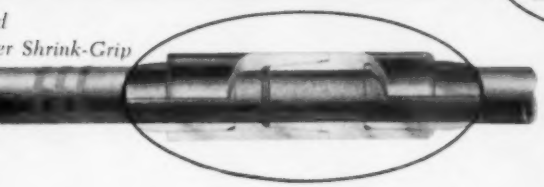
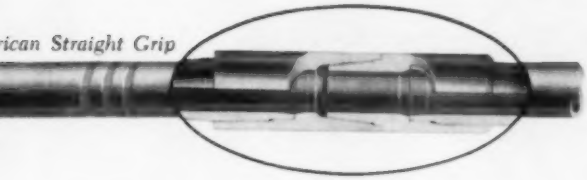
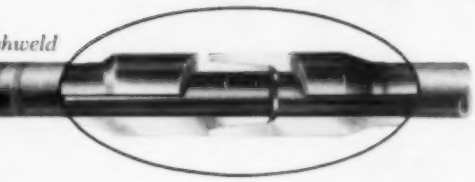
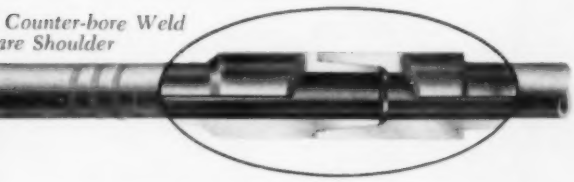


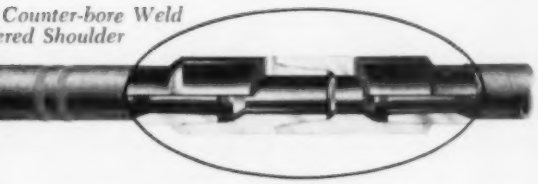


The Quality Names in Tool Joints Go with Quality-Built

YOUNGSTOWN DRILL PIPE







ded joints are made by American, Hughes and Reed.

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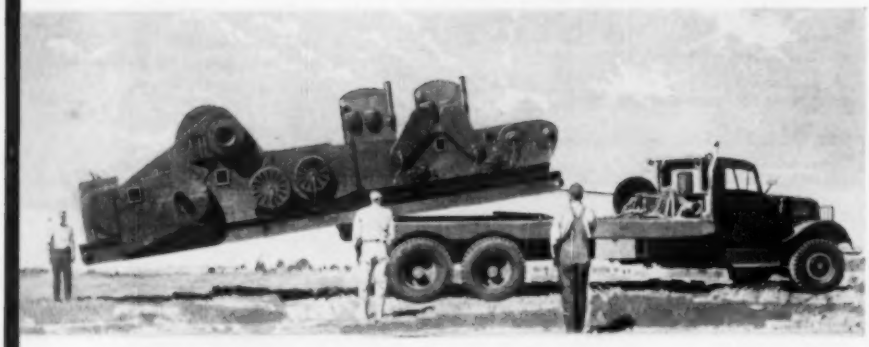
The familiar orange bands say Youngstown Drill Pipe and Top Quality



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Two or three engines can be installed . . . depending upon *your* power requirements. Clutches are on the end of the shafts for simplified maintenance . . . flat or step setting easily accomplished . . . engine drives through torque converters, fluid couplings or Fawick Airflex clutches as preferred. Longer rig life is assured by pressure oil lubrication to chains and bearings, reducing maintenance.

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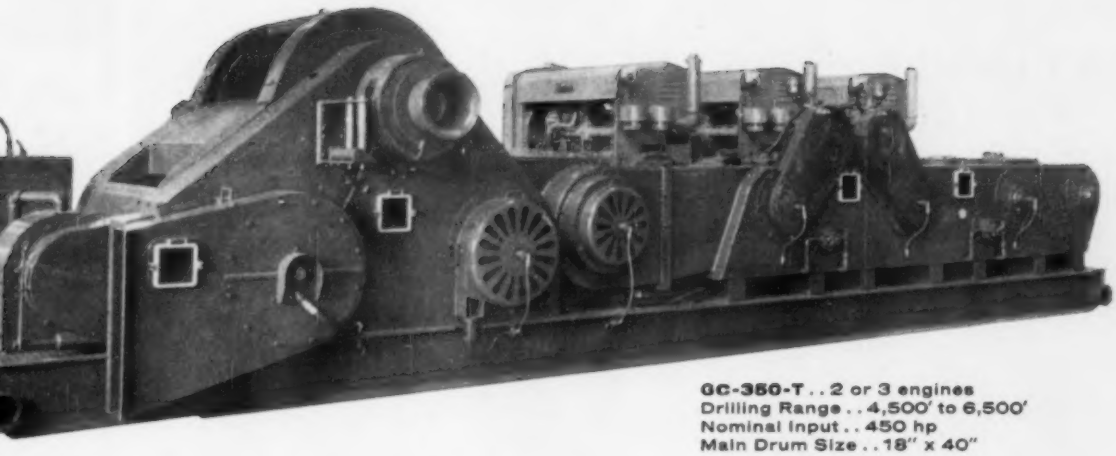

GC-350-T . . 2 or 3 engines
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Nominal Input . . 450 hp
Main Drum Size . . 18" x 40"

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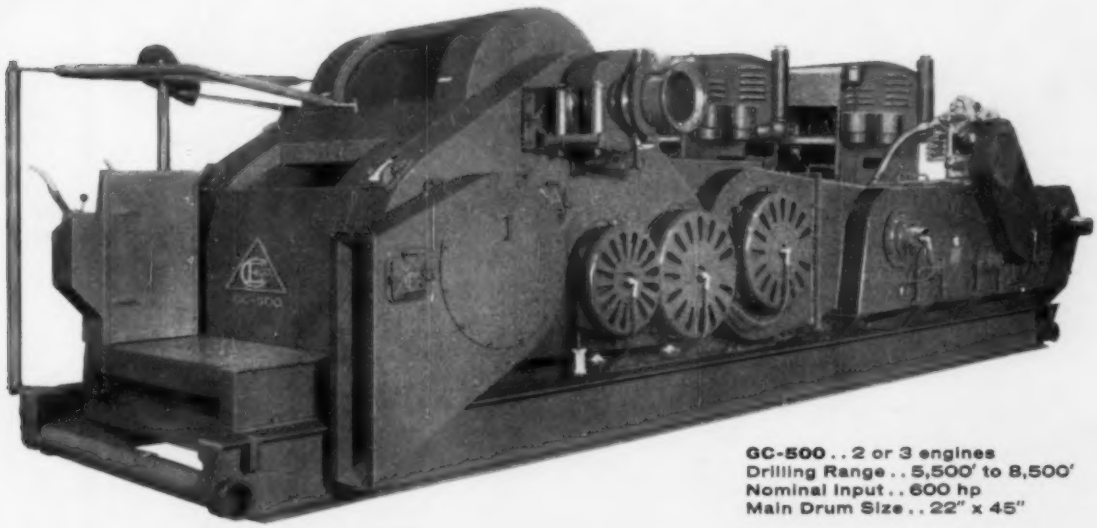

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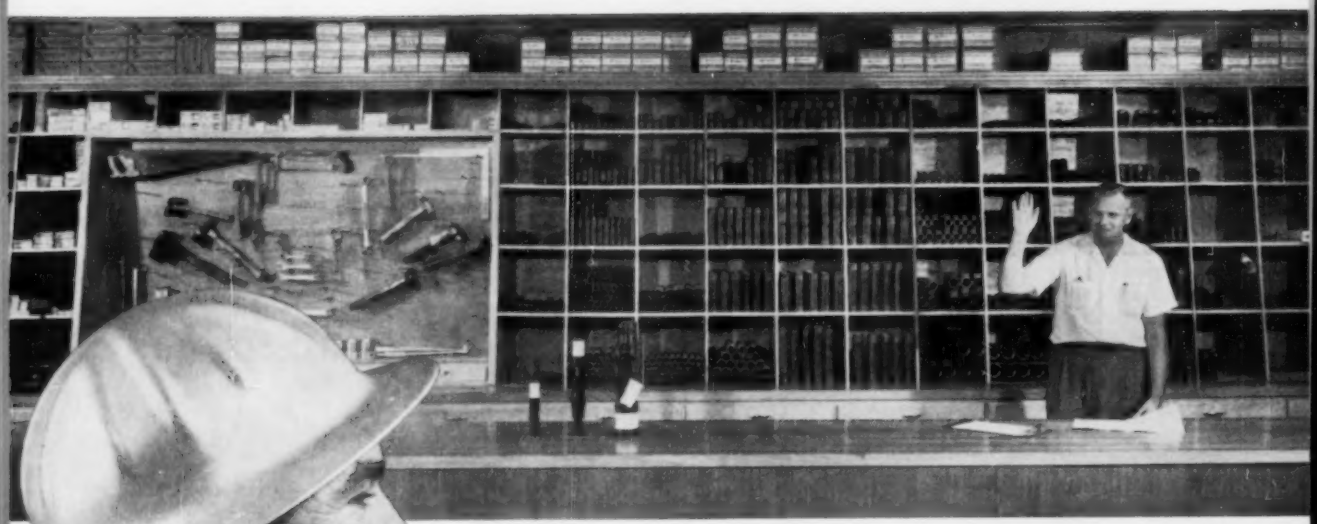

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Here's where fresh activity is hatching, as . . .

Springer Tries Again

By John C. McCaslin
District Editor

SIX YEARS AGO this page began with the statement, "Recent developments in southwestern Oklahoma have turned up additional evidence that the immense importance of the Springer sands from the standpoint of ultimate reserves has not been overestimated." These remarks were made at the time when Springer exploration was heavy along the southeastern end of the Anadarko basin (west of the Golden Trend at Purdy), and in the Ardmore basin of southern Oklahoma.

This was also the period when oil hunters began to look longingly at the Springer's prospects to the northwest along the Wichita Mountain front. Until last month, however, with the exception of continued Springer advances in the Purdy area and the discovery of oil in this sand at Gotebo many miles to the northwest, little has been heard of this famous Oklahoma pay sand.

Shell revives a name . . . Shell Oil Co. bounced the Springer back onto the wildcat objective list at its North Carter Springer discovery a few miles southwest of Elk City field in Beckham County. The significant strike flowed 21,000 M.c.f. of gas daily, open flow, with 400 bbl. of distillate from open hole at 10,212-65 ft., moving Springer production to its westernmost point more than 40 miles west of Gotebo to a point known as the Sayre uplift.

Shell tapped the Springer at North Carter in what is believed to be a stratigraphic trap against the basal Pennsylvanian unconformity in Springer beds that are steeply dipping. These Springer sands were laid down and then disturbed by the Wichita Mountain orogeny, and then buried by later Pennsylvanian deposition.

Of long significance . . . Oil was discovered in the Springer sands at Velma back in 1944, and has since been found productive in many Ardmore and southeastern Anadarko basin fields. After a rather slow start, Springer's importance spread out in a northwestward direction toward Chickasha, Knox, Cement, and other structures along the southern end of the Anadarko basin.

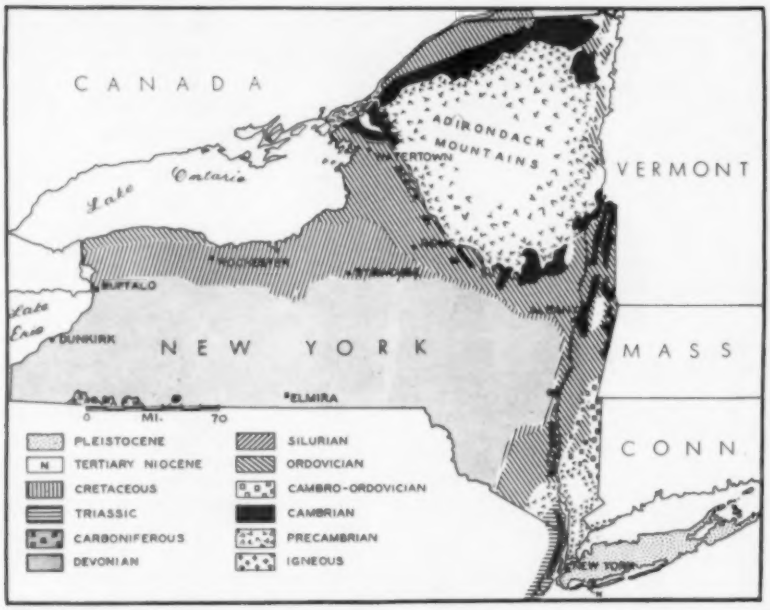
The Springer sand is known from the Pauls Valley uplift on the east almost to the Texas Panhandle along the front flank of the Wichita Mountains. It thins northward from the axis of the basin toward the wedge edge formed by truncation which took place between Morrow and Des Moines time. This was the same erosional period that cut the Springer off the Wichitas and from the crests of larger structures in the Ardmore basin and on to the northwest.

Springer sands are widespread in the Anadarko basin's trough area and for years have raised speculation that deep production might be found here and there along the Wichita Mountain front and on out into the basin's bottom. Several famous Oklahoma wildcats tapped the Springer but didn't find commercial oil. They were located in Caddo, Gray, Custer, and Washita counties.

Firing new enthusiasm . . . Springer enthusiasts will be watching closely development of new North Carter field as Shell gets under way at a northwest offset, the 11,000-ft. 1 Patten. North Carter may well be a real milestone toward Springer production in southwestern Oklahoma and out into the Anadarko basin itself. North Carter is a rank Springer discovery and the 40 miles between it and Gotebo possibly hold tremendous potential.

The hunt for Springer production is and has been a tough one. Springer production has been found in reservoir beds that are deeply truncated with the traps confined to the flank of a large closed anticline. In looking for Springer oil in these types of traps, production has been found on the crest of anticlines which are not so deeply truncated.

Much is left for the Springer explorer in Oklahoma. Up to now the Springer search has been on the flanks of known structures. Shell has revitalized this search. The question is now —What lies in the bottom of the basin?



THIS MAP shows New York's geological formation location. Major gas production has been from the Oriskany and Medina sandstones in western New York.

Let's take a look at . . .

New York's Geology

By W. L. Kreidler

THE oil and gas fields of New York are in the northern part of the Allegheny synclinorium (see map). The oil-producing horizons are in the Canadaway group of the Upper Devonian. Total production to January 1, 1957, is estimated at more than 198,000,000 bbl. of crude oil; approximately 134,000,000 bbl. have been produced since 1919 by secondary-recovery operations.

Major gas production has been from the Oriskany and Medina sandstones in western New York and from the Trenton limestone in central New York. Lesser amounts have been produced from the Potsdam sandstone, Lockport dolomite, and from various shallow Upper Devonian reservoir beds. Total known reserves are estimated at 60 billion cubic feet.

Regional geology of New York State . . . The two exposed Precambrian highs are the Adirondack Mountains in northeastern New York and the Hudson Highlands in southeastern New York. (See map). The Cambrian formations are exposed on the north, east, and south flanks of the Adirondack Mountains with the Cambro-Ordovician formations in southeastern New York. Ordovician formations are found south and east of Lake Ontario, in the St. Lawrence River Valley, Lake Champlain region, and Mohawk and Hudson river valleys. The Silurian formations form an east-west belt from the Niagara River to Albany and create the Catskill front from Albany south to Port Jervis, N. Y. South of the Silurian formations east-west belt and west of the Catskill front are the Devonian formations with a few scattered outliers of the Devonian east of the Catskill front. In southwestern New York are remnant exposures of the Carboniferous.

This gives us a generalized picture of the surface geology of New York State. The older Paleozoics are progressively overlain to the south by younger Paleozoics in the Allegheny synclinorium; the regional dip is away from the Precambrian highs of New York and the Laurentian highlands of Canada.

There are three bands that enter or border New York State. The main basin where all or most of the oil and gas production is found is in the Appalachian area of the Allegheny synclinorium, which extends north into New York State. In New York, this synclinorium is bounded on the east by the Adirondack axis; on the north by the Adirondack Mountains and the Frontenac axis; and on the west by the Cincinnati axis.

There are two other basins in New York that should be considered as to their oil and gas possibilities. These are the Champlain and the St. Lawrence geosynclines.

The Champlain basin is bounded on the west by the Adirondack axis and the Adirondack Mountains and to the north enters the St. Lawrence basin. On the west, it is bounded by the Quebec axis and on the south extends into New Jersey and Pennsylvania.

The St. Lawrence basin is bounded on the northwest by the Precambrian Laurentian highlands with the Frontenac axis and Adirondack Mountains to the south.

Since the geology of the basins vary, it is best to discuss their oil and gas potentials separately and in the order given.

Allegheny Synclinorium

In the Allegheny synclinorium, several formations have shown or indicate potential oil and gas reservoirs.

Oriskany . . . The type locality of the Lower Devonian Oriskany is the Oriskany Falls, Oneida County, where it is a white, friable, almost pure quartz sandstone. In wells, the Oriskany is generally a medium-grained, dark gray to light gray quartz sandstone. The formations of the Helderberg stage of eastern New York are the basal Devonian. This is overlapped by the Oriskany which is the basal Devonian in west-central New York. The Oriskany itself in eastern New York is overlapped by the Schoharie-Esopus which wedges in between the Oriskany and Onondaga. Elsewhere in New York, the Onondaga directly overlies the Oriskany, when it is present, and becomes the basal Devonian of western New York.

The Oriskany is widely reported in wells drilled in the Devonian area of New York, but has been notably absent in places. This absence may be due to erosion, or the possibility exists of nondeposition because of a pre-Oriskany high. Either may account for the no-sand area as outlined by wells drilled for Oriskany gas production.

The Oriskany sandstone varies in

Author is senior geologist, New York State Geological Survey, New York State Museum and Science Survey, Albany. Paper presented at the spring meeting of the Eastern District A.P.I. Division of Production, Pittsburgh, Pa., May 1-3, 1957.

porosity but averages about 9 per cent. In many places the sand is very permeable, due to the presence in the producing area of small open fractures or open-joint planes that are only partially sealed by quartz crystals. This accounts for the high productive capacity of the Oriskany sandstone in the New York area.

The gas in the Oriskany sandstone formation for the most part has been controlled by anticlinal structures; these are sometimes closely associated with faulting that probably occurred during the late Paleozoic mountain building. It is believed that there are still small structural and stratigraphic traps in western and central New York that will prove to be productive from the Oriskany sandstone. An example of this is Allegany State Park pinchout field, Cattaraugus County, New York, which was discovered in December 1955. In 1956, this field furnished over a billion cubic feet of gas and produced over 7,000 bbl. of distillate.

In southeastern New York, west of the Adirondack axis, in Delaware, southwestern Otsego and Chenango counties, only three wells have penetrated the Oriskany formation. They are the 1 M. Hazlett in Delaware County that had a show of gas from the Oriskany (22 ft.) and a show of gas from the upper 10 ft. of the Vernon (Bloomsburg) red beds. The 1 E. Matteson, Otsego County, and 1 C. C. Lobdell, Chenango County, had a few rounded quartz grains with glauconite present at the Oriskany horizon. The Oriskany sandstone formation is known to crop out, along the Catskill front, just north of Port Jervis. The presence of the Oriskany standstone along the Catskill front and in the Hazlett well, would indicate that the Oriskany should be present in the subsurface west and south of the Hazlett well and west of the Matteson and Lobdell wells.

Lockport formation . . . In July 1932, gas production was found 111 ft. below the top of the Lockport in Phelps Township, Ontario County. Gas was at several different horizons in the Lockport, for the most part, apparently sealed in coral reefs, with some gas being found in the most basal part where the dolomite is slightly sandy. The presence of oil in the upper 30 ft. of the Lockport has also been reported in the vicinity of Rochester, N. Y.

The Lockport formation south of its outcrop, underlies the Allegheny synclinorium in western and central New York. From Lake Erie east of Cayuga County, it maintains its thickness and then thins and shales out along the outcrop belt in the vicinity of Utica. In wells, the Lockport is found as far east as Franklin Township, Delaware County, and it apparently thickens in the subsurface south of the outcrop belt.

Many wells have drilled through the Lockport dolomite in the search for Medina gas in Erie, Genesee, Wyoming, and Ontario counties. Apparently, however, no geological or seismograph exploration work has been carried on for oil and gas reservoirs in the coral reefs of the Lockport formation south of Lake Ontario.

Medina formation . . . The oldest (1858 or 1859) and steadiest gas production in western New York is from the Silurian Medina formation. The Whirlpool (White Medina) sandstone is the main gas-producing horizon, although some gas is found in the higher Grimsby (Red Medina) and occasionally in the next high group, the Clinton. The Whirlpool thins rapidly eastward from Buffalo and does not crop out east of the village of Medina, Orleans County. It is found in wells as far east as Canadaigua Lake. In the Kesselring well, Van Etten Township, Chemung County, the White Medina is over 100 ft. thick.

The homoclinal structure of the rocks in the Medina fields is in marked contrast to the usual anticlinal structures found in the Oriskany gas fields in southern New York. In the Medina fields the gas is in the porous sandstone lenses sealed by nonpermeable parts of the reservoir.

Oneida formation . . . The Oneida conglomerate of Silurian age was penetrated by the C. C. Lobdell well, Columbus Township, Delaware County. This is a conglomerate white to green sandstone with clear angular quartz fragments. In Oneida County, the lowest Silurian formation is represented by the Oneida conglomerate, formerly classed as topmost Medina but now considered to be of Clinton age. The base of the Oneida here marks the Ordovician-Silurian boundary. In the C. C. Lobdell well, the presence of connate water in the Oneida and close association with the underlying Pulaski and Trenton — Black River gives the Oneida a favorable aspect as a reservoir bed, especially to the south and southeast of the Lobdell well where it may be controlled by structural or stratigraphic traps.

Oswego . . . The type locality of the Upper Ordovician Oswego is in the vicinity of Oswego, N. Y. Here the sandstone beds are a graywacke and have a thickness of 100 ft. The Oswego increases in thickness to the south and southwest with a maximum thickness of 600 to 700 ft. along much of the Allegheny front in Pennsylvania where it is locally known as the Bald Eagle sandstone. In New York, the Oswego sandstone beds are conglomeratic to the east. They also thin rapidly and disappear by unconformity to the east. The 1 C. C. Lobdell in Columbus Township, Chenango County, which drilled to the Precambrian, did not find the Oswego formation present.

In wells to the west of its type locality, the Oswego is a concealed formation. The sandstone beds become finer grained westward from the type locality in New York and grade laterally into shales. It has been penetrated by a few wells in western New York.

In Arcade, Wyoming County, the Oswego sandstone beds are 117 ft. thick with one or two of the beds showing good porosity and adequate permeability. The formation here is a very fine to fine-grained, light greenish-gray and slightly calcareous sandstone. To the south and the southeast, it is believed that with the thickening of the sediments, increase in grain size and close association with the underlying marine shales, the Oswego would make an excellent reservoir for oil or gas, especially where it is controlled by structural or stratigraphic traps.

Trenton . . . The type locality of the Ordovician Trenton is at Trenton Falls, on West Canada Creek in Oneida County, where it is predominantly a limestone. In other localities the limestone layers alternate with shale. The upper limestone beds of the Trenton change southeastward partly by gradation and partly by offlap into thick beds of Utica and Canajoharie shales. The lower limestone beds of the Trenton thin as they extend southeastward. The Trenton west of its type locality is predominantly a limestone.

The first drilling for Trenton gas production was in Wayne, Oswego, Oneida, and Onondaga counties where the Trenton limestone is at shallow depths. The Trenton limestone beds are not of sufficient porosity to serve as reservoir rocks, nor are they dolomitic, as are the Trenton beds of Ohio, which have been so productive of oil and gas. In the Trenton fields, gas is found in fractured zones, joint planes, cavities, shale partings, and shale beds. It is also believed that coral reefs within the Trenton serve as a reservoir for some of the gas.

The most promising area for oil and gas production from the Trenton would be southwestern New York where the Trenton formation may be more dolomitic.

Theresa or passage beds . . . Outside of the type locality of the Theresa formation at Theresa N. Y., Upper and

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Lower Cambrian, the so-called Theresa beds are not Theresa but are passage beds between the Potsdam formation and the Hoyt or the Little Falls formation. According to Fisher and Hanson (1951): "The formation is redefined to comprise the sandy dolomites, dolomitic sandstones, and calcareous sandstone lying below the Hoyt limestone and above the Potsdam sandstone." In its type locality, it has a maximum thickness of 80 ft. C. R. Fettke in his well-known record of the I K. R. Wilson at Arcade, Wyoming County, New York, shows a maximum thickness of 643 ft. for the formation while some geologists prefer to place all or most of these passage beds in the Potsdam formation. This shows the widespread area covered by the so-called Theresa (passage beds) throughout central and western New York.

Some of the sandstones in the passage beds showed good porosity, averaging around 33 per cent and are water bearing. Those beds that show good porosity would make excellent reservoirs for gas and oil where the accumulation is controlled by structural traps.

Potsdam . . . The Upper Cambrian Potsdam is a fine to medium-grained sandstone. It has good porosity as evidenced by the show of gas and connate water produced from several wells. It underlies most of New York southwest and west of the Adirondacks and is also found north and northeast of the Adirondacks. The Potsdam shows a thickness of 37 ft. in the C. C. Lobdell well in Chenango County and a thickness of 176 ft. plus in the K. R. Wilson in Wyoming County.

A few wells have reported shows of oil and water in the Potsdam sandstone. In the southern counties, where the possibilities of structural control of reservoirs could be expected, there have been no tests of the Potsdam. It is estimated that the depth of the Potsdam ranges from 6,000 to 12,000 ft. below sea level along the New York-Pennsylvania border.

Champlain Basin

The active and potential producing horizons of the Devonian, Silurian, Ordovician, and Cambrian formations of the New York portion of the Appalachian synclinorium have been discussed and areas have been suggested which seem favorable for extended exploration. So far, nothing has been said about the similar possibilities of the Champlain geosyncline. This folded basin of sedimentary rocks is located in eastern New York.

East of the Champlain and Hudson valleys in New York State, the sedimentary rocks of the Champlain geosyncline are discontinuously covered by the Taconic thrust sheet which moved westward from what is now the New England area. Remnants of the sheet are found in southeastern New York but from Columbia County north through Washington County, it forms an almost solid cover.

The surface beds of the Champlain geosyncline in the Hudson - Mohawk Valley region are the Schenectady, Canajoharie, and Snake Hill shales—all Ordovician in age. Pockets of gas have been found in these shales but none has been discovered in commercial quantities. Most geologists agree that oil and gas possibilities of the pre-Silurian rocks in the southern extension of the Champlain geosyncline, east of the Catskill front, are poor. This is based on the high degree of folding and faulting developed in these rocks during the Taconic disturbance at the close of the Ordovician.

West of the Catskill front in Sullivan County, southeastern Delaware County and parts of Ulster County, the oil and gas possibilities have not been adequately explored. Only one well has drilled through the Devonian and Silurian formations in this area. The Herdman well in Ulster County, with an estimated thickness of 11,800 ft. of Paleozoic sediments, reached the Ordovician Normanskill shale at a depth of 6,365 ft. It showed several porosity zones in the Devonian Onondaga and the Silurian Shawangunk with a good show of gas in the Devonian Schoharie-Esopus.

The Devonian Oriskany was absent from the Herdman well but believed present in the subsurface west and southwest of the above well as the Oriskany crops out, along the Catskill front, north of Port Jervis, N. Y., and was found in the subsurface in the Hazlett well, Delaware County.

The Devonian and Silurian to the south and west of the Herdman well, Ulster County, have good possibilities of containing reservoirs for oil and gas, especially where they are controlled by structural or stratigraphic traps. It is recommended that several wells test the Ordovician and Cambrian east of the Adriondack axis on structural or stratigraphic traps.

The above region, which is located between the Catskill front and Kay's Adirondack axis, needs detailed geological field work supplemented by seismograph work to locate structural and stratigraphic traps before carrying out a drilling program.

In eastern Saratoga County and western Washington County, some of the Middle and Lower Ordovician and Upper Cambrian formations are present. In Saratoga County, the following formations should be considered for oil or gas: (1) The Gailor porous dolomite, (2) Mosherville sandstone, (3) Hoyt limestone reefs, (4) Galway (Theresa) sandstone and dolomite, and (5) the Potsdam sandstone.

In western Washington County, the Orwell limestone, Beekmantown reefs, Theresa sandstone and dolomite, and the Potsdam sandstone also have reservoir possibilities. A shallow well drilled near Fort Ann in Washington County reported a show of oil. In the northern part of the Champlain geosyncline, Clinton County area, the oil and gas possibilities, the author believes, are perhaps better than they are in Saratoga and Washington counties. The Middle and Lower Ordovician and the Upper Cambrian formations have an estimated maximum thickness of 2,000 to 2,900 ft. The Trenton, Isle la Motte, and Lowville formations are geographically restricted. The formations with oil and gas reservoir beds are the Day Point limestone reefs, Theresa or Transitional beds of dolomites and sandstones, and Potsdam sandstone.

In this part of the Champlain basin, the Potsdam sandstone has thickened greatly and is only slightly disturbed. A well drilled near Morrisonville, Clinton County, penetrated 775 ft. of this formation but was abandoned for lack of funds before the total thickness could be determined. A show of oil was reported in the sandstone.

In eastern Saratoga County, and western Washington County, the sedimentary rocks are not thick, in places they do not have the proper impervious cap rock and were folded and faulted during the Taconic disturbance at the close of the Ordovician.

St. Lawrence Basin

The southwestern part of the St. Lawrence geosyncline enters northeastern New York State. The Potsdam sandstone crops out north of the Adirondack Mountains with only a thin covering of the Ordovician to the north and west. Due to the lack of an impervious cap rock over this east-west

The Oriskany Sandstone . . .

"The Oriskany is widely reported in wells drilled in the Devonian area of New York, but has been notably absent in places. This absence may be due to erosion, or the possibility exists of nondeposition because of a pre-Oriskany high."

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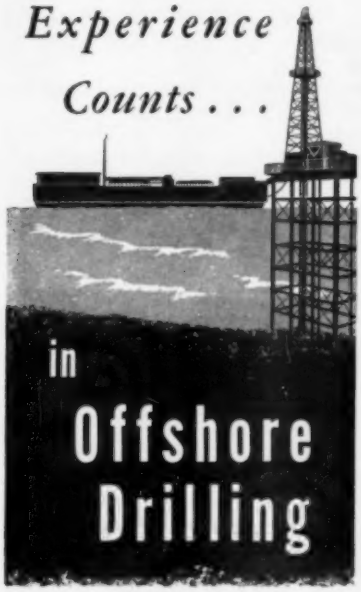

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belt of Potsdam sandstone which has an estimated maximum thickness in the east of more than 1,000 ft., it is believed that the oil and gas possibilities of the St. Lawrence geosyncline in New York are poor.

In the Allegheny synclinorium, the formations discussed underlie most of New York State south of their outcrop belt. Now it is a matter of testing them, at depth in southwestern New York, central New York, offshore drilling in Lake Erie, and unexplored areas in southeastern New York. Wouldn't it be wise to test the deeper horizons on some of the known Oriskany structural traps in southern New York before they are put to underground storage for gas?

Before a drilling program is carried out in the above mentioned areas, it is recommended that detailed geological field work be carried out, supplemented by geophysical work to locate structural and stratigraphic traps which would localize the drilling program.

In the Champlain geosyncline, the region west of the Catskill front and east of the Adirondack axis is believed to have excellent oil and gas possibilities.

There is only one other area that deserves some consideration and that is Clinton County in the northern Champlain basin where the possibilities are fair in the Theresa or passage beds and Potsdam at depth in those areas where they may be only slightly disturbed by the Taconic disturbance of the Ordovician. **End.**

BOOK

OCCURRENCE OF OIL AND GAS IN TEXAS, edited by Frank A. Herald. Published by University of Texas. 456 pp. $10.

This book is the result of a cooperative project between the West Texas Geological Society and the Bureau of Economic Geology. Supervising committees and 104 authors of field papers acted for the society. The publication includes descriptions of 112 fields. Most of the field papers include structure maps and graphic typical section of rocks penetrated, with electric log. Cross-sections are shown for a number of the fields.

EXPLORATION THIS WEEK

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Canadian Well Logging Society Plans Symposium

A 2-DAY international symposium will be held by the Canadian Well Logging Society in Calgary, Alta., November 14-15. Canadian and American authors will present 19 papers which will range from the purely theoretical to the practical, from the question of distribution of neutrons, for example, to the familiar "Is It Good Enouh to Set Pipe On?"

This technical society has been operating only 2 years but with such success it is known in the oil centers of the United States. The society is composed of geologists and engineers who use well logs, drill-stem-test data and core analyses to evaluate formations, with emphasis on the analysis of electrical, acoustical, and radioactivity logs.

American authors . . . Original papers are presented for discussion at monthly technical meetings; more than half of these papers have been given by American authors. The society also carries on studies of basic data essential to the adequate use of logs in Canada, such as composition and resistivity of formation waters, variation in bore-hole temperatures, mud and mud-filtrate characteristics, etc.

The majority of authors who will attend the symposium are from major oil companies and the remainder from logging and service companies.

Registration fees will be low and advance registration of out-of-town visitors is invited. Address correspondence to A. A. Brown, California Standard Co., Calgary.

G. S. SHAW
Committee Member

EDGAR BURGE
Committee Member

SYMPOSIUM PAPERS

1. Trends in Formation Evaluation (Canadian).
2. Interpretation of Capillary Pressure Data from Carbonate Reservoirs (American).
3. Application of Mercury Injection Data in Carbonate Reservoir Evaluation (Canadian).
4. Log Interpretation in Heterogeneous Carbonate Reservoirs (American).
5. Use of Microlaterologs to Obtain Porosity in Shaly Sands (American).
6. Departure Curves for the Self Potential Log (American).
7. Water Resistivity Determination in Specific Areas (American).
8. Porosity—Deflection Relationship for Neutron Logs (Canadian).
9. Density Logging in Western Canada (Canadian).
10. Reservoir Parameters from the Gamma Ray Log (Canadian).
11. Logging Programs in the Virden-Roselea Manitoba Area (Canadian).
12. Regional Log Analysis (Canadian).
13. Determination of the Content of Radioactive Elements by Gamma Ray Spectroscopy (American).
14. Factors Affecting Elastic Wave Velocities in Porous Media (American).
15. A Method of Formation Testing on Logging Cable (American).
16. Quantitative Analysis of Drill-Stem-Test Pressure Charts (American).
17. Locating Gas-Oil Contacts in Partially Depleted Reservoirs (Canadian).
18. An Investigation of Recorded Bottom-Hole Temperature While Running Logs (Canadian).
19. Standardization and Calibration of Radioactivity Logs (American).

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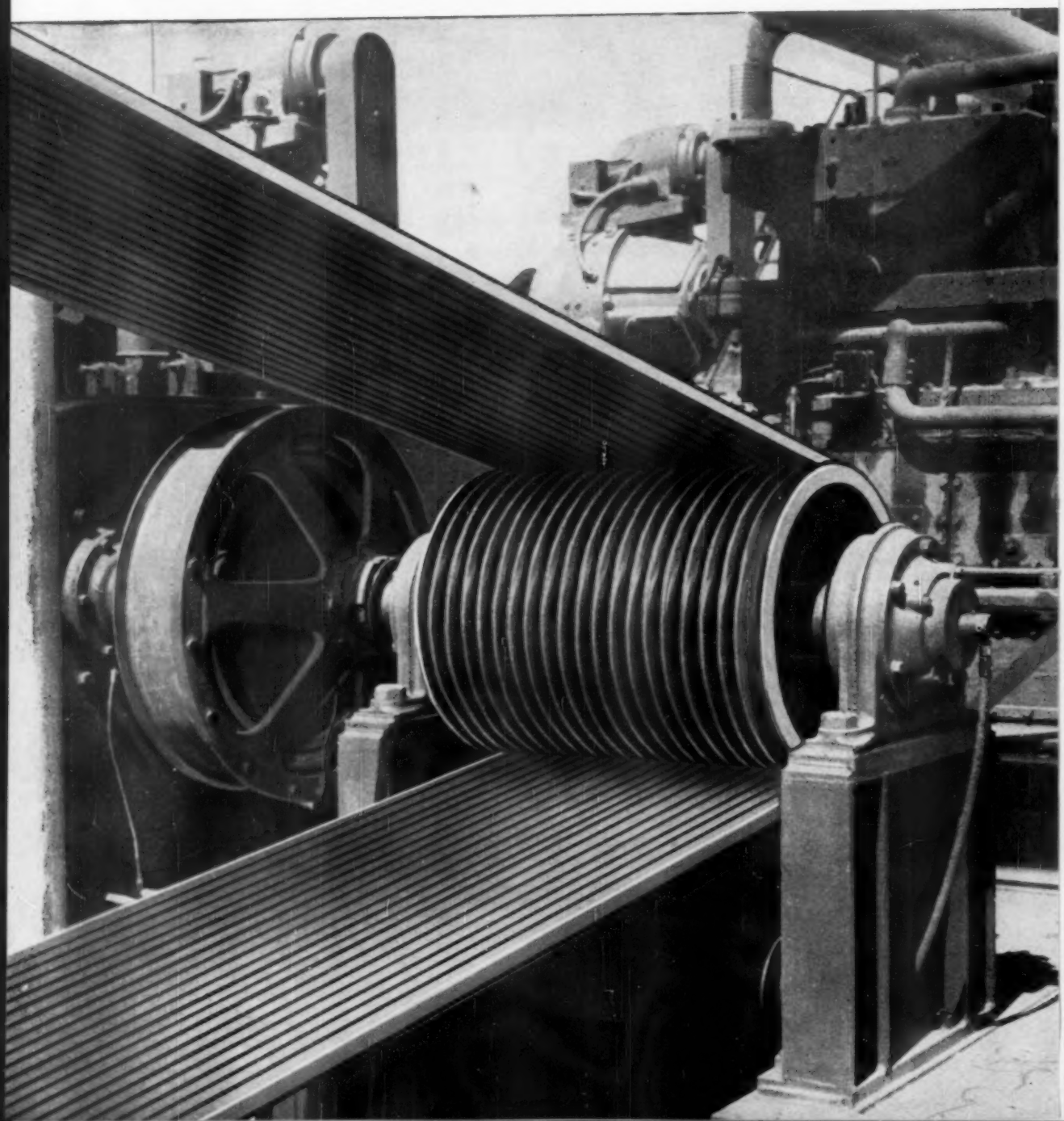

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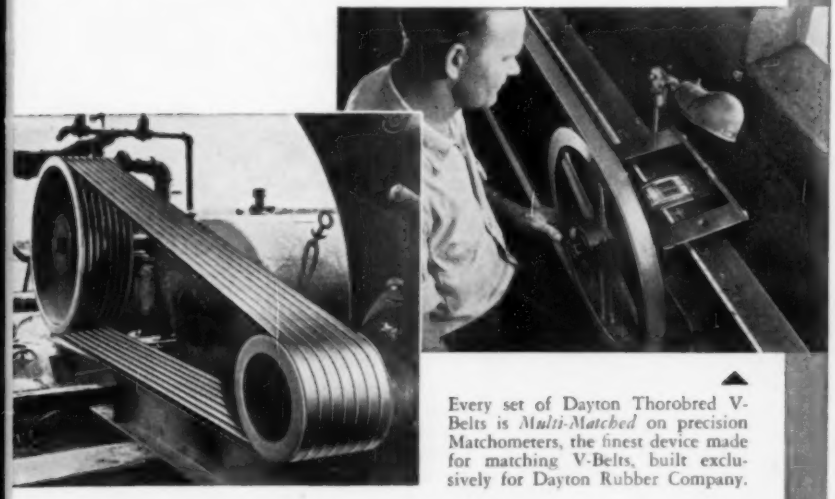

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EXPLORATION HIGHLIGHTS

APPALACHIAN

OHIO

Another Part of New Castle Pool Opened

A semiwildcat in the Walhonding area of the New Castle Township Coshocton County pool opens another section for development. The R. B. Weed et al 1 M. W. C. District, Lot 5 second quarter, logged Clinton at 2,862-2,927 ft. with 25 bbl. natural and 650 bbl. in 24 hours after fracture.

Big Producers Are Rule in Franklin Pool

Large producers are the rule of the recent completions in Franklin Township, Wayne County. Smith Petroleum Co. 1 Mose Yoder, Section 10, gaged 60 bbl. natural from Clinton at 3,565-3,621 ft. and made 721 bbl. after fracture. Their 2 Mose Yoder gaged 50 bbl. natural from sand at 3,569-3,636 ft. and made 1,128 bbl. after fracture.

Good Gas Well Flows In Gratiot Pool

In the Gratiot pool, Hopewell Township, Muskingum County, Devonian Oil & Gas Co. 1 J. P. Brandon, Section 4-S topped the Clinton at 3,273 ft. and drilled in to 3,297 ft. with an open flow of 2,000,000 cu. ft. natural and an estimated 10,000,000 cu. ft. after fracture.

EASTERN KENTUCKY

Breathitt County Wildcat Completed

In Breathitt County and located on South Fork of Quicksand Creek, United Fuel Gas Co. have completed their wildcat 1 L. W. Wolferberger et al. The well was drilled to a total depth of 2,968 ft. through the Clinton (Silurian) shale and plugged back to 1,110 ft. Casing was then perforated opposite the Pennsylvanian salt sand with a resulting 582,000 cu. ft. of gas daily. Formation markers include: Big lime 1,335 ft., Berea 1,955 ft., Corniferous 2,374 ft., Big Six sand 2,570 ft. and Clinton shale 2,880 ft.

CALIFORNIA

Union Finds New Pool at Fruitvale

Union Oil Co. of California tapped a new pool 1 mile west of Fruitvale field in Kern County with a 6,500 ft. wildcat in NW SW 17-29s-27e. The discovery was completed at 4,200-4,355 ft. after being plugged back to 4,360 from its original total depth of 6,500 ft. It was put on the pump making 75 bbl. daily of 20°-gravity crude, 70 per cent cut.

Apex Stakes Wilmington Test

Apex Petroleum Corp., Ltd., has staked location for a wildcat 2 miles south of the present western limits of the Wilmington field in Los Angeles County. Location is in SE SW 7-5s-13w, in the Los Angeles harbor area near San Pedro.

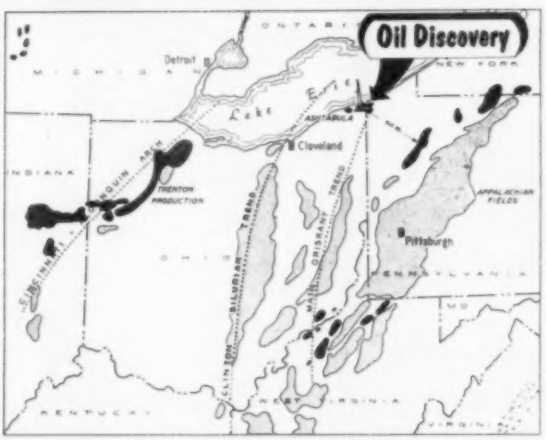
Getty Misses at Bardsdale

Getty Oil Co. failed in an attempt to extend production in the Bardsdale field a half-mile west with a 10,000 ft. wildcat in SW NE 11-3n-20w, in Ventura County. Getty first took the hole to 10,000 ft., plugged back to 5,444 ft. when a core bit stuck at 6,989 ft. and a fish job on it was unsuccessful. The hole was then redrilled to 6,000 ft. when the abandon decision was made.

Reserve Reports Good Tests On Vedder Extension at Tejon

Reserve Oil & Gas Co. was nearing completion of its third successful Vedder well in the Tejon North field with a 12,020 ft. southeast offset to the discovery well. Reserve ran a formation test on the new well, 388-18 Reserve-Butler-Wehr, in the middle of the M-3 zone. The test was open 3 hours and recovered 4,405 ft. net rise, including 4,051 ft. of 32.8°-gravity crude.

Biggest Eastern Strike in 40 Years



BENEDUM-TREES ET AL. report what is possibly the biggest oil strike in the East in nearly 40 years at a wildcat 10 miles south of the town of Conneaut in extreme northeastern Ohio's Ashtabula County.

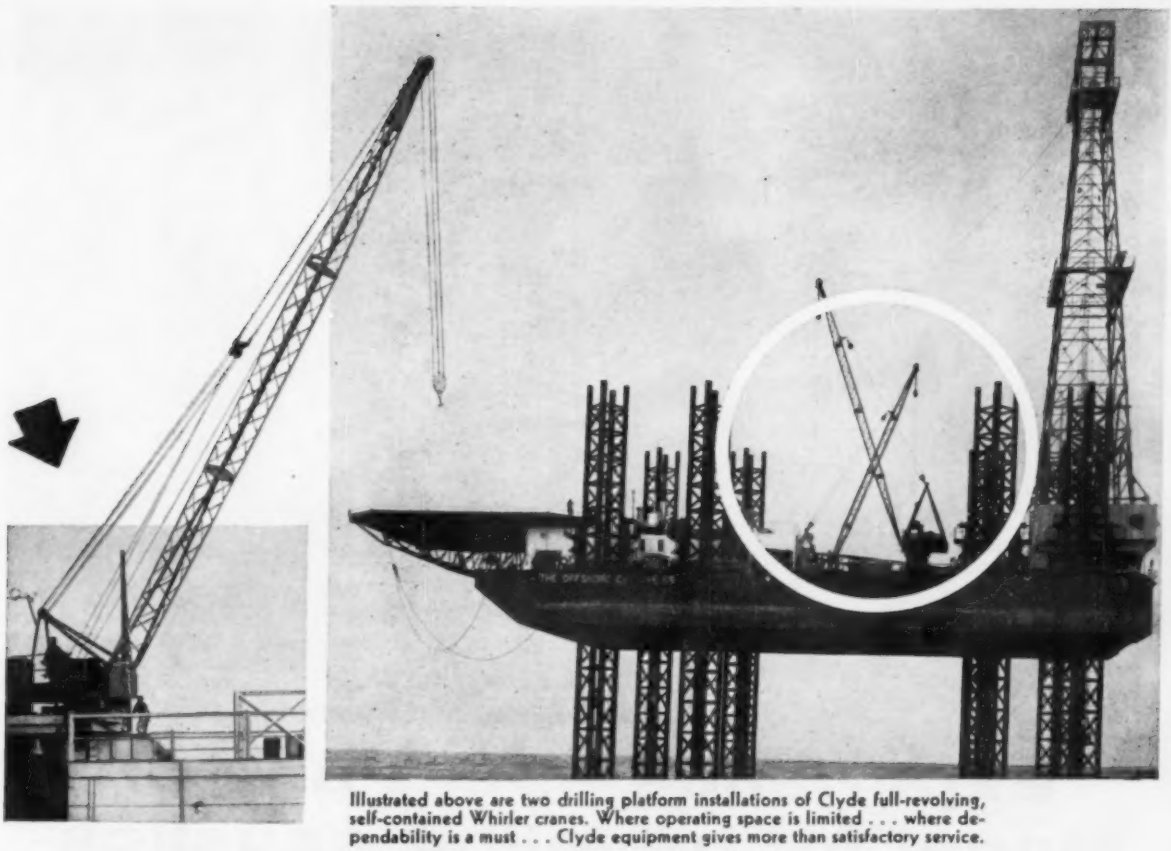
The 1 Scribner, 6 miles west of the Pennsylvania line, flowed 700 bbl. of oil to tanks before being shut in due to lack of storage space. Production is from 48 ft. of Medina-Silurian sand, a very thick section for the East. Total depth of this significant oil strike is 3,292 ft.

CANADA

ALBERTA

Iosegun Added to Slave Point Agenda

First Virginia Hills-Swan Hills-Edith Lake—now the Kaybob-Iosegun River area of northwestern Alberta. These two regions of the province, only 35 miles apart are astounding the oil industry of North America, as five wells drilled within 8 months by three separate operators have flowed oil from a structure, not previously productive of oil in commercial quantities, namely the Beaverhill Lake sector of the Middle Devonian (sometimes referred to as Slave Point). The latest of the Slave Point discoveries drilled by The California Standard Co. and British American Oil Co., Ltd., occurred this week when their well, 7-33 Iosegun, 5 miles



Illustrated above are two drilling platform installations of Clyde full-revolving, self-contained Whirler cranes. Where operating space is limited . . . where dependability is a must . . . Clyde equipment gives more than satisfactory service.

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For off-shore use where service sources are many miles distant where parts would have to be shipped by water or air and down time is extremely costly . . . there you will find Clyde Whirler Cranes.

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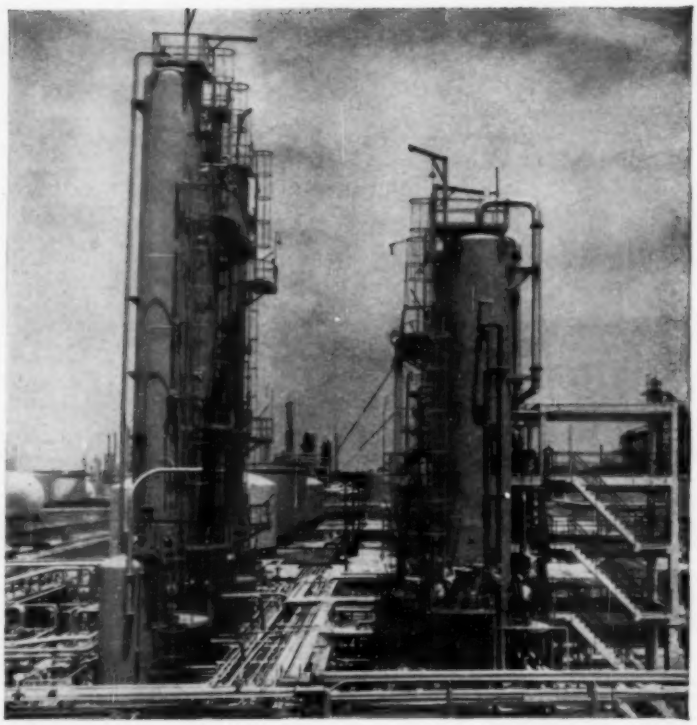
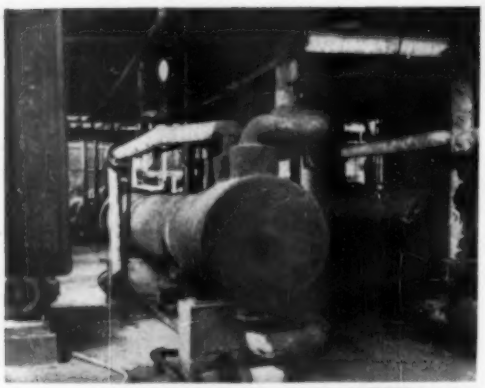
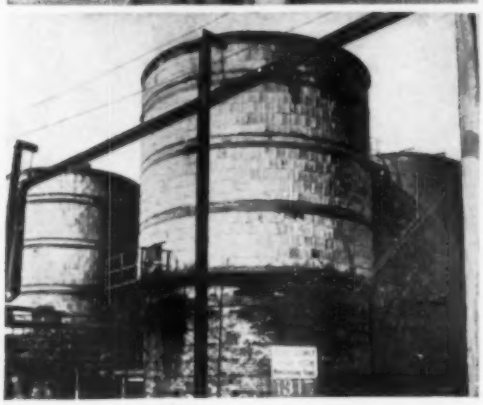


Take towers — This one is saving a large southern refinery $20,000 a year in maintenance costs. Solid 7/16-in. Monel* nickel-copper alloy walls save the caustic stripping tower in the refinery's Unisol unit from the corrosive bite of 47° Baume caustic at 290° to 300°.

Experience spurs use of Monel for handling caustics





Heat exchangers (left) — Here's a preheater that is exposed to contaminated caustic entering the regenerator tower and to pure caustic leaving. Despite severe conditions, the preheater is giving trouble-free service. Shell and tubes are Monel alloy.

Agitators (lower left) — In this large agitator tank at an eastern refinery, bottoms and sides up to 6 ft. were replaced with Monel alloy. A wise choice. Monel alloy has proved to be the most economical material to use for this service.

Experience like this has led to the use of Monel alloy for a variety of other caustic processing units: reboiler tube bundles, hot caustic lines and caustic storage vessels, to name a few. In petrochemical plants using caustics, Monel alloy guards product purity.

Making available field experience in overcoming caustic corrosion is one of Inco's many services. Why not take advantage of this service? Send us details of your problem and our Research and Development Engineers will work with you to provide a solution.

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south of previous discovery, came in flowing 130 bbl. per hour on initial drill-stem test in the sector. Reserves of the two areas are still an unknown factor. There has been no exploratory work carried out between the two regions.

The California Standard - British American 7-33 Iosegun is on LSD 7, 33-63-19w5, 5 miles south of the Phillips-California Standard-British American A7-22-64-19 Kaybob Beaverhill Lake oil find and 35 miles southeast of oil production in Sturgeon Lake South oil field.

Drill-stem test at the new indicated success was conducted over a 52-ft. interval below 9,855 ft. and the oil flow was measured at 130 bbl. per hour, 42.5°-gravity.

More Gas Found In Calgary Area

Another D1 gas success in the immediate Calgary area of southern Alberta, and possibly the best to date, was revealed by the Jefferson Lake Sulphur Co., who is currently carrying out a drilling program on Mobil Oil Co. of Canada, Ltd., farmout rights in the area. This latest indicated producer, Jefferson Lake C.P.R. 25-11 Calgary, previously discovered distillate-bearing gas in the basal Blairmore horizon and the latest evaluation in the new zone flowed at a rate of 5,200,000 cu. ft. daily. This program is being carried out by the firm in an effort to prove up sufficient gas and sulphur reserves to enable it to construct a sulfur processing plant in the region. The D1 in the general Calgary-Okotoks area is renowned for its sulfur bearing qualities with as high as a 34 per cent content.

New Rocky Mountain Front Discovery Reported

The Central Foothills Agreement Group consisting of British American Oil Co., Ltd., Triad Oil Co., Royalite Oil Co. and Sun Oil Co. has indicated natural gas success at another exploratory test which it is currently drilling along the Rocky Mountain front of central west Alberta. The newest of the three, which have all occurred in the last 2 or 3 weeks, is the B.A.-Triad et al 6-4 Lambert Creek venture, the most northwesterly of the strikes.

Unlike the first two discoveries, which indicated their success from the Mississippian horizon, the new success indicated its production from the D1 zone of Devonian.

Drill-stem test in that formation, below 12,800 ft. gassed at a maximum rate of 10,600,000 cu. ft. daily but

ONE MAN, and a "Varec" PULSE CODE System, can gauge and record 100 tanks in 12.3 minutes– AUTOMATICALLY

Quite a job for one man—and quite a saving for his employer. A saving in labor, time and overflow losses, and an increase in production efficiency. The secret, of course, is the "Varec" PULSE CODE equipment wisely specified by the farm operator. He has discovered what thousands of successfully operating "Varec" installations have been proving for years: that automation *means* reduced operating costs, and automation by "Varec" *guarantees* it.

"Varec" has been the leader in the field of automatic tank gauging since its inception. This progressive leadership, coupled with over 30 years experience in faithfully supplying the nation's petro-chemical industry with products noted for their dependability and excellence of design and manufacture, has resulted in the "Varec" PULSE CODE Telemetering System—the finest in the field.

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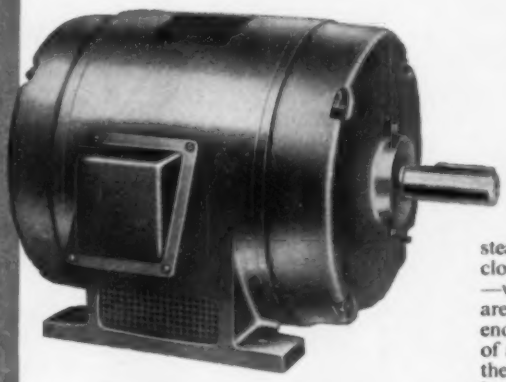
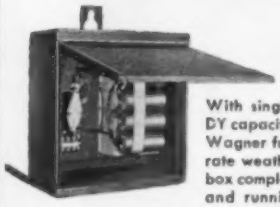


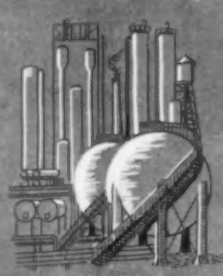


With single-phase Type DY capacitor start Motors, Wagner furnishes a separate weatherproof control box complete with starting and running capacitors and voltage relay.

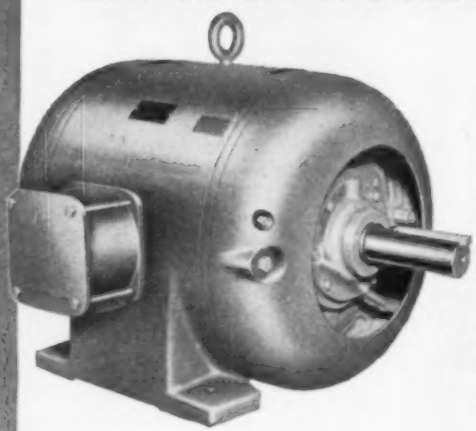
OIL WELL PUMPING MOTORS

Wagner cast-iron frame oil well pumping motors, either polyphase or single-phase, are especially designed for rugged, steady, outdoor service. The enclosures are completely drip-proof —virtually splash-proof. Air intakes are located at the bottom of the endplates to admit a cooling flow of air to the motor, while retarding the entrance of water. Outlets are located at the base of the frame, one on each side. Screened openings keep reptiles or small animals from entering the motor. The conduit box is moisture-proof and dust tight. For locations where only single-phase current is available, Wagner can furnish high power factor type capacitor-start motors with the same enclosures. You can get Wagner Oil Well pumping motors *from stock* in your immediate area.

...in the refinery



EXPLOSION-PROOF MOTORS



These powerful Type JP polyphase motors are expressly built for applications in explosive atmospheres. They are approved for Class I Group D hazardous locations. Totally-enclosed fan-cooled construction, with frames and endplates of cast iron, makes them suitable for indoor or outdoor use and for installations where corrosion is a problem. Available in ratings through 250 hp.

For full information, write for Bulletins MU-132 and MU-137. Thirty-two branch offices are ready to assist you in any motor application problem.

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decreased to 4,800,000 cu. ft. daily when a packer used to separate the particular interval tested from the rest of the hole became loose.

The strike 6-4 Lambert Creek, is being drilled on LSD 6, 4-51-21w5. At that location it is 30 miles northwest of the group's 12-30 Lovett River venture which recently flowed gas at rates as high as 5,000,000 cu. ft. daily, 19 miles north of the B.A. 5-36 Mountain Park successful gas completion and 70 miles northwest of the other recent gas discovery for the team 6-10A Stolberg.

This development is being carried out on a spread of 14 separate petroleum and natural gas reservations contained in the Central Foothills Agreement. There are approximately 1,300,000 acres included in the tract.

Foothills Tests Drilling

Sunray and Pacific are also drilling two important wildcats in the Foothills area of southwestern Alberta. These include an 8,500-ft. Rundle limestone test in the Sullivan Creek area and an 11,500-ft. test in the same sand in the Keystone Valley area. The Sullivan Creek wildcat is located approximately 15 miles northwest of Savanna Creek gas field and the Keystone Valley wildcat is located several miles northwest of Jumping Pound gas field and on the trend of field production.

BRITISH COLUMBIA

Success Reported at Montney and Charlie Lake

Sunray Oil Co. of Oklahoma, the wholly owned subsidiary of Sunray Mid-Continent Oil Co., and Pacific Petroleums, Ltd., announced a successful drill-stem test at a stepout location in Montney field, British Columbia.

The 5 Montney, located in LSD 14, 31-86-19w6, encountered the top of the Triassic "D" zone at a depth of 4,816 ft. and drilled to 4,844 ft. On test of the interval from 4,819-44 ft. the well flowed gas at a maximum rate of 11,295 M.c.f. per day through a ½-in. choke. Bottom-hole flowing pressure was 1,700 psi. with shut-in bottom-hole pressure of 1,845 psi.

Casing is now being installed preparatory to completion of the well. Montney No. 5 is located on Permit No. 126 containing 149,440 acres. Sunray's interest in this permit is 50 per cent.

Sunray and Pacific also announced completion of 93 Charlie Lake in the Fort St. John area of British Columbia as a successful Gething sand oil

Young HC® UNITS

do 4 jobs at the same time!

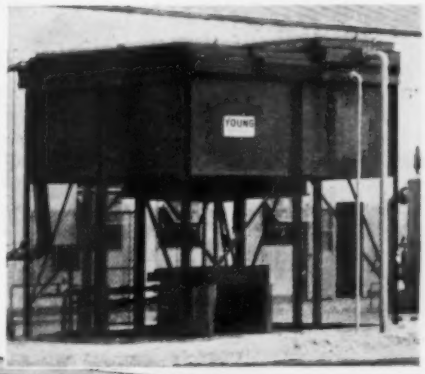

Photo shows compact installation of the five HC Units, model 1212, and one unit in detail.

✶ Cool Engine Jacket Water
✶ Cool Lube Oil
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Five Young HC Units are used to cool the five 660 hp Beaird-Ingersoll Rand compressors at this Texas plant of the Natural Gas Pipe Line Company of America.

The fans of this highly efficient installation are operated by hydraulic motor drive, in turn driven by powered hydraulic pumps. For other types of installations there are available v-belt, gear reducer and direct electric motor drives.

Young HC Units are built for rugged service, providing the efficiency of vertical air discharge and economy of compact Young design with the versatility of multiple unit combination. If you have a cooling or condensing problem, consult Young Radiator Company. Their wide experience is at your service—there is no obligation.

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Creative HEAT TRANSFER ENGINEERS
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well. This well, located in LSD 13, 5-84-18w6, produced 250 bbl. of 27°-gravity oil in 16 hours while flowing through a ½-in. choke with 100-75 psi. following a fracture treatment. Perforations were from 3,322-38 ft.

Additional drilling activity in which Sunray is participating with Pacific in British Columbia includes a 6,800-ft. Permo-Penn test in Airport field, at Fort St. John, a 5,300-ft. Triassic test in Buick Creek field, approximately 50 miles northwest of Fort St. John, and a 6,800-ft. Mississippian test, approximately 40 miles west of Fort St. John.

ILLINOIS BASIN

ILLINOIS

Big Well Reported At Hamilton Well

E. H. Kaufman 3 W. J. and J. W. Flannigan, NE SE SW 23-6s-5e, 6 miles south of McLeansboro in Hamilton County, is one of the best wells completed in Illinois this year. It flowed 1,437 bbl. of oil per day from the Aux Vases at 3,117-48 ft. after fracture treatment.

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PVC PIPE

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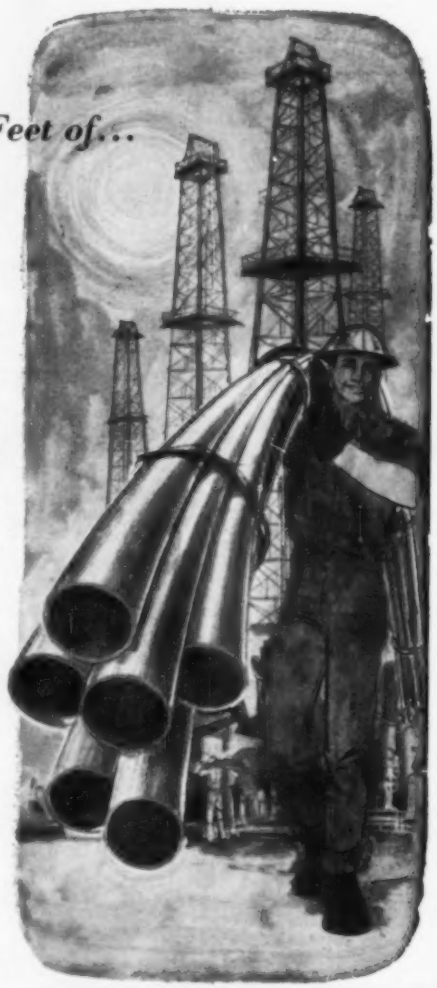

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LOUISIANA

SOUTH

Second Well Completed In Deep St. John Field

Howell, Holloway & Howell have confirmed their recent discovery of deep gas-condensate production about 3 miles north of Chacahoula field, in northwestern Lafourche Parish.

Their second well, a Peltier, east offset to the discovery well, is productive from a slightly shallower zone, perforated at 15,090-15,141 ft. The discovery well's pay is perforated at 15,-204-10 ft.

Tested through ¾-in. choke, the new well flowed 322.56 bbl. of 46°-gravity oil with 3,852,000 cu. ft. of gas per day. Flow was under pressure of 5,125 psi. Flow of the discovery well was at the rate of 256 bbl. of 44.1°-gravity condensate with 3,100,000 cu. ft. of gas per day through ¼-in. choke.

Total depth of the second well is 17,212 ft.

The area, about midway between production on the northeast flank of Chacahoula salt dome and Laurel Ridge field, has been designated as St. John field.

MICHIGAN

Third New Field In Two Weeks Seen

The third new field prospect in 2 weeks gave Michigan its best boost of the year coupled with a stepped-up play in the Hillsdale County area.

Glen Cain 1 Lauterwasser-Dow, NE NW NW 10-19n-17w, Mason County, wildcat 16 miles north of Pentwater oil field, averaged 33-44 bbl. swab and flow from Traverse limestone 1,603 ft. pay.

● Roush and Vorhees 1 Ostrander, SW NW SE 26-10n-3e, Saginaw County, completed for pool discovery at 2,308 ft. with production of 50 bbl. per day average 10 days on test in Squaw Bay section of Traverse. Same operators staked new location ½ mile northeast.

● Flowing 70 bbl. per day from Niagaran dolomite at 2,547-2,618 ft., Glen A. Mills 1 Watos SE SW NW 22-4n-15e, St. Clair County, established first oil horizon in old Peters (Salina 2,400 ft.) gas field.

● Four new locations surveyed in Scipio field, Hillsdale County, following completion of Aurora-McClure 1 Stevens, 10-5s-3w, 148 bbl. per hour from Trenton limestone at 3,769-72 ft.

(Continued on page 246)

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is important to sound
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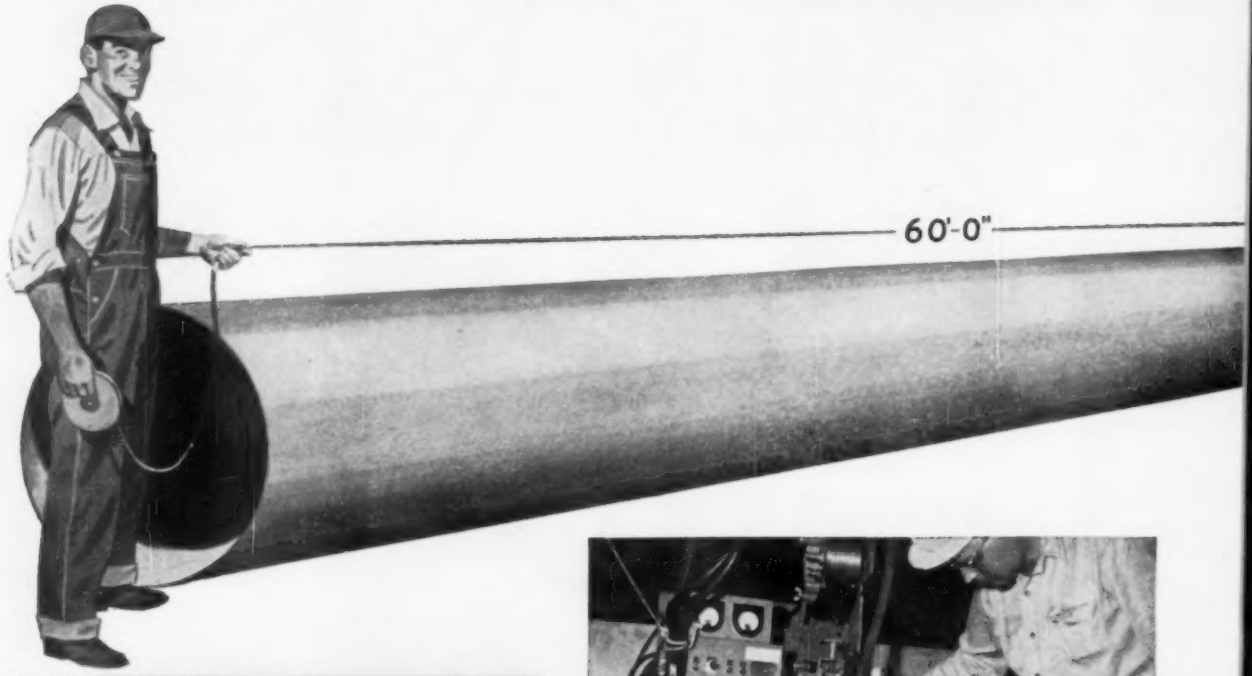
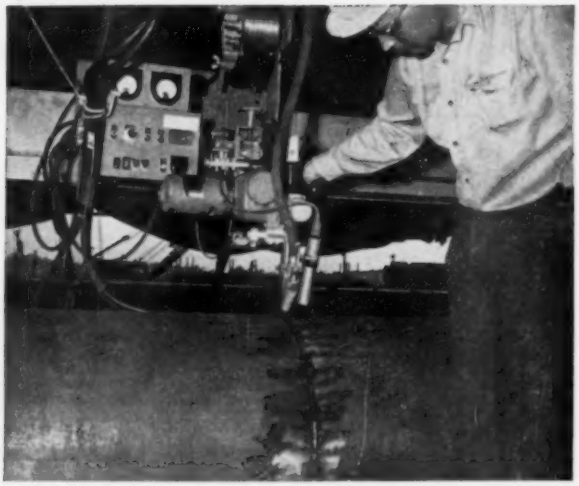
NEW "SUPER-SPAN" JOINTS LINE PIPE *speed schedules*



Stringer bead for joining two 30-foot joints of Republic Electric Fusion Weld Line Pipe is applied at "line-up" station. Perfect alignment is possible with precise separation of lands on rust-free bevel. Note rubber-tired rolls used to cradle pipe.



Here the first of two fully automatic passes is made by submerged arc welding, employing latest equipment and methods. The finished mid-weld of Republic's new "Super-Span" Pipe is as reliable as the longitudinal weld.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

OF REPUBLIC FUSION WELD *up to 33%!*

Sixty feet in length, these extended joints of Republic Fusion Weld Pipe require only 88 welds to make up a mile of line. Progressing at the rate of 150 girth welds per day—about par for welding-crews under normal conditions—daily production will total 9000 feet.

Compare this to the 6000 feet of line you complete using 40-foot joints. It adds up to a minimum savings of 33% in laying time when you use the new Super-Spans. In a 500-mile line, for example, the *savings* would amount to *147 working days!*

This new, economical length, a Republic exclusive, is produced by joining two 30-foot joints under ideal welding conditions. Each welding operation is carefully controlled, resulting in a mid-weld of equal quality to the longitudinal weld.

Consistent uniformity like this is standard in every joint of Republic Electric Fusion Weld Line Pipe. Great care is taken to be certain circumference is always constant. This permits fast, accurate line-up for high-speed girth welding. Uniform wall thickness assures an even distribution of metal all around the pipe—with no thin spots to worry about. Precision manufacturing techniques produce high ductility and yield strength, to keep maximum dependability in high-pressure service.

Republic, a leading pipe producer for more than 25 years, makes steel pipe for every oil and gas handling need. Electric Fusion Weld comes in sizes from 24″ through 30″ O.D.; Electric Resistance Weld from 2⅜″ through 16″ O.D.; and Continuous Butt Weld from ¼″ through 4″ nominal.

Get all the facts from your local Republic office. Or mail coupon for literature.

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MISSISSIPPI

Adams County Discovery Opens New Wilcox Field

Marlin Exploration, Inc., has a new Wilcox discovery well in southwestern Adams County. Location is only a half mile north of the discovery well, now abandoned, of Glen Aubin field, but separated from it by dry holes. It is about a mile north of the only currently producing well in the field.

The well, 1 Pierce Buter, in 15-5n-3w, is completed in the Parker sand (Wilcox), perforated at 6,663-66 ft. Its flow through ¼-in. choke was at the rate of 288 bbl. of 43.6°-gravity oil per day. Pressure was 280 psi. on the tubing. Total depth is 6,810 ft. Promising oil shows also were logged in the Wilcox "4,600-ft." sand, and in a thin lens above the Parker.

The discovery has been designated as Ellis Cliffs field, after the plantation on which it is located.

NEW MEXICO

SOUTHEAST

Lea County Wildcat Flows Pennsylvanian Oil

Another pool was assured for the busy area some 18 miles west, and slightly south, of Lovington. This portion of Lea County has seen at least a half dozen new Pennsylvanian or Permo-Pennsylvanian pool openers over the past year.

The latest discovery prospect is Neville G. Penrose, Inc. 1 Texas Gulf-State in 34-16s-34e. On drill-stem test at 11,646-74 ft., gas surfaced in 38 minutes at the rate of 2,000 M.c.f. per day; water blanket in 1 hour and 24 minutes and oil in 1 hour and 38 minutes. It gaged 65 bbl. of 40-gravity oil in 3 hours, under flowing pressure of 1,088-1,700 psi. Fifteen-minute shut-in pressure reached 4,340 psi. Choke size on the flow test was not reported. There was no water indicated.

The interval tested was identified as Pennsylvanian, and possibly the Canyon section. Drilling continued below 11,674 ft.

R. C. Lipscomb 1 Harris, northwest outpost to the Bronco field in Lea County, recovered oil on drill-stem test in the Wolfcamp.

A 2½-hour test at 9,047-98 ft. reversed out 5,100 ft. of 42°-gravity oil, with no water. Top of the Wolfcamp was 9,050 ft., or minus 5,241 ft. Drilling continued on a 12,000-ft. contract. Production in Bronco field is from the Siluro-Devonian. Location of 1 Harris is NE NW 2-13s-38e.

NORTH DAKOTA

New Field Looms For Divide County

Divide County appears to be in line for a new Nesson-Madison Mississippian discovery. The indicated strike is Spartan Drilling 1 Eckland, SW NW 9-162n-95w, 1 mile west of Noonan town and 2 miles northeast of Noonan field. The well flowed 68 bbl. of oil daily on ¼-in. choke from perforations at 6,739-43 ft.

This new strike is about 15 miles west of the big play now under way in Burke County and is another step toward the increased activity off the Nesson anticline in North Dakota.

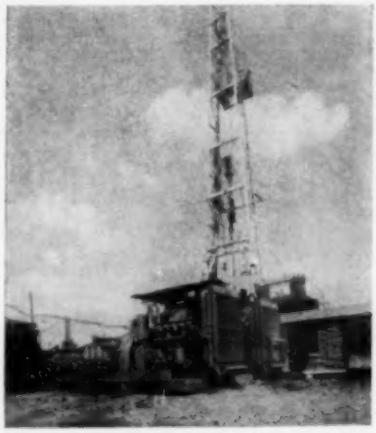
Lignite Field Continues Its Fast Growth

Burke County's prolific new Lignite field added two flowing wells last week. The wells, both extensions, are Northern Natural Gas Producing Co. 1-A Bunting in C NW SW 5-162n-91w, and Pan American Petroleum Corp. 1 Holte in C NW SE 5-162n-91w.

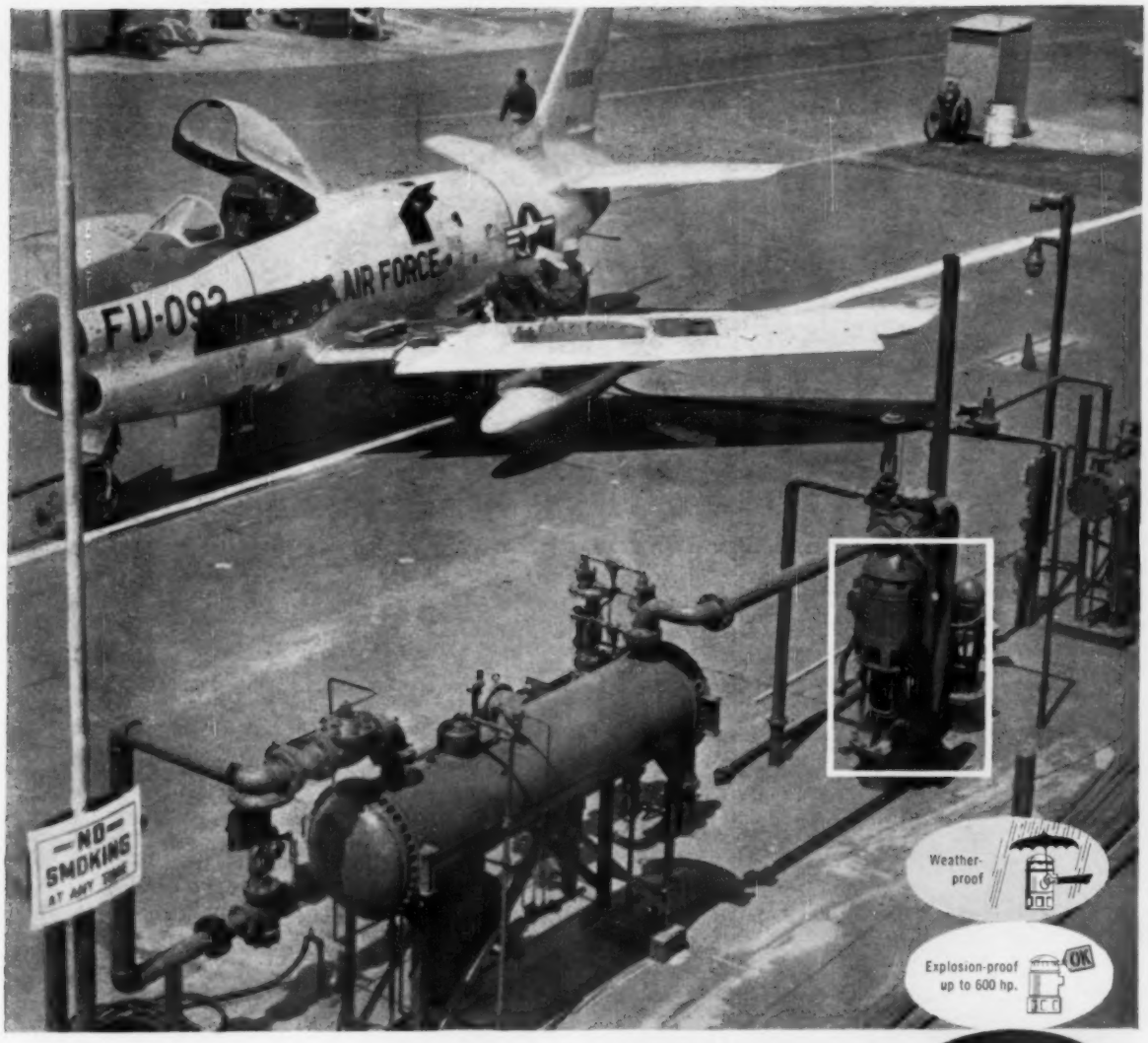
The A-1 Bunting flowed 190 bbl. of oil and 25 bbl. of water daily from Midale at 6,078-6,104 ft. This well is a northwest extension discovery. The Holte well flowed 199 bbl. per day from perforations at 6,066-94 ft. on 19/64-in. choke. The Holte well is a north extension. There are two other extensions at Lignite shut in for production tests and two wells are drilling toward the Midale objective.

OKLAHOMA

Oklahoma's Deepest Hole



Magnolia Petroleum Co. 1 Sterba-Ordovician, deep wildcat in Cement field, Caddo County, is Oklahoma's deepest hole at 20,446 ft. Operators plan to plug back up the hole and attempt to complete in the Springer at 14,510-40 ft.



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NORTHWEST

Second Well Added to New Ellis County Pool

Shell's new gas pool in Ellis County added its second well last week. Shell 1 Hoern, C NE SW 32-24n-25w, 1 mile south of the field discovery well, flowed 17,000 M.c.f. of gas per day on 1-in. choke plus 15 bbl. condensate per million from Morrow sand at 8,261-90 and 8,343-61 ft.

Another well in the field, the 2 White in C NE SW 31, is drilling toward the Morrow-Pennsylvanian objective.

Oklahoma's Deepest Production Comes from This Well →

British-American Oil Producing Co. recently set the state's deepest oil production at its 1 Krieger deep test in Stephens County, Oklahoma. The Knox field wildcat flowed 6,200 M.c.f. of gas per day from Oil Creek-Ordovician sands at 16,525-46 ft. Total depth is 17,484 ft., fourth deepest well in the state.

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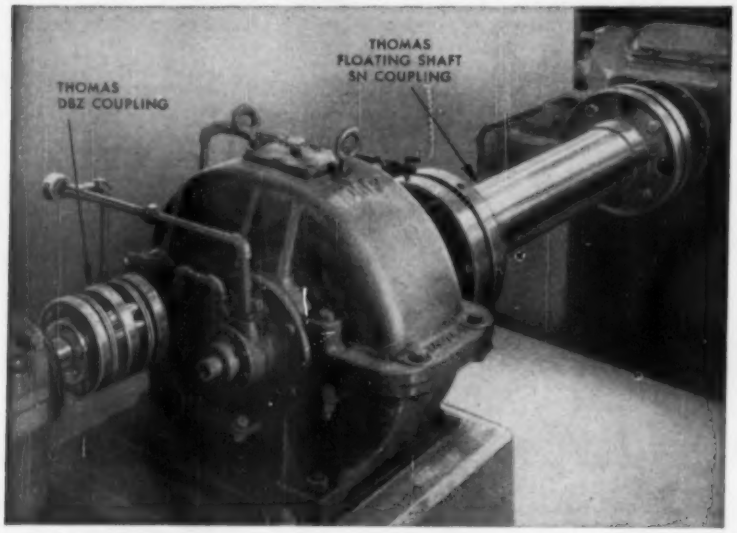

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THOMAS FLEXIBLE COUPLING COMPANY
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OREGON

Tragedy Mars Oregon Test

Drilling of General Petroleum Corp.'s 1 Long Bell in Sulphur Springs-Siuslaw area of Douglas County was marred recently when Donald W. Green, co-partner in the drilling firm of Green & Heiser Drilling Co., contractor on the well, was killed in a plane crash at Coos Bay, Oregon. Green and Velton Walker, veteran tool pusher on the Oregon wildcat, were returning to the home base in Bakersfield, Calif., in Green's light plane when it plunged into the bay shortly after taking off. Walker was also killed in the crash. Meanwhile, drilling on the wildcat continued below 7,865 ft.

ROCKY MOUNTAINS

WYOMING

Stepout Discovery Finaled At Dead Horse Creek

A 1½-mile southeast stepout at Dead Horse Creek field in the Powder River basin pumped 326 bbl. of oil daily from Parkman perforations at 6,914-53 ft. The well is The California Co.'s 1 Government-Davis in C NE NE 30-49n-75w, Campbell County.

Another well, the 2 Government-Davis, is drilling below 6,810 ft. in C NE NW 29-49n-75w. Farmers Union is working at a well between the new California well and the field itself. This company's 2 Ferguson-Government, SE NW SE 13-49n-76w, recovered 5,220 ft. of oil during a test.

Dead Horse Creek field is one of the most significant wildcat happenings in Wyoming this year. Its location in a formerly rank wildcat section of the Powder River basin makes it a closely watched new area. Production is from Parkman-Mesaverde (Cretaceous).

UTAH

Operations Begin at Book Cliffs Wildcat

Sunray Mid-Continent Oil Co. has completed spudding operations on a 6,600-ft. wildcat test in the Book Cliffs area of Grand County, Utah. The well will be drilled to test the Jurassic Entrada formation.

Operations got under way this week after the operator completed construction of 7 miles of road in Hay canyon, an area that is susceptible to flash floods during this time of year. The rugged Book Cliffs have a relief of 2,000 ft. from the bottom of the canyon floor to the top of the escarpment.

The well, the 1 Utah Federal, is located 660 ft. from the north line and 660 ft. from the east line of 9-17s-23e. Sunray holds in excess of 30,000 net acres in the vicinity.

TEXAS

NORTH

Taylor County Wildcat Makes Fry Sand Discovery

Jocelyn-Varn Oil Co. and Jack F. Grimm 1 Helen Howarton in the southwestern corner of Taylor County, found the Ellenburger dry but completed as a big Fry Sand discovery. Location is 2 miles south of the town of Shep, in Section 39, Block 460, J. Walker Survey.

No. 1 Howarton picked top of the sand at 4,674 ft. on elevation of 2,106 ft. Completion potential through ½-in. choke, from perforations at 4,676-87 ft., was 422 bbl. of 48°-gravity oil. Tubing pressure was 200 psi.

This well had attracted considerable attention as an Ellenburger exploration, but little drilling formation was released. Formation top on the Ellenburger was 5,445 ft., and total depth was 5,506 ft.

Two-Zone Discovery In Nolan County

Champlin Oil & Refining Co. and R. J. Caraway 1 Beckham has been completed as a Strawn and Ellenburger dual discovery. The well also indicated production while testing in the Tannehill sand. Location is 6 miles southwest of Trent in Section 2, Block X, TUP Survey.

Sample top on the Ellenburger was 6,163 ft. on elevation of 2,113 ft. Completion potential from perforations at 6,183-6,206 ft. and 6,244-55 ft. was 204.8 bbl. of 47°-gravity oil a day. Production was through ⅜-in. choke, with gas-oil ratio of 570:1.

Final test in Strawn limestone was 128 bbl. of 45°-gravity oil a day, pumping, with gas-oil ratio of 475:1. Production was from perforations at 5,447-79 ft.

Archer County . . . Mississippian oil in the Scotland, South-Caddo field has been opened at E. B. Clark Drilling Co. 1 Bruno Morbitzer, in Section 38, Block 3, Clark & Plumb Subdivision. General location is east-central Archer County.

Pumping potential from the Mississippian at 5,597-5,700 ft. was 102 bbl. of 44°-gravity oil a day. Gas-oil ratio

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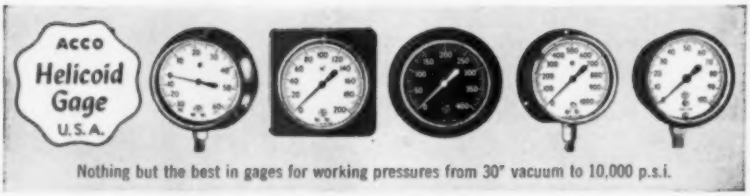

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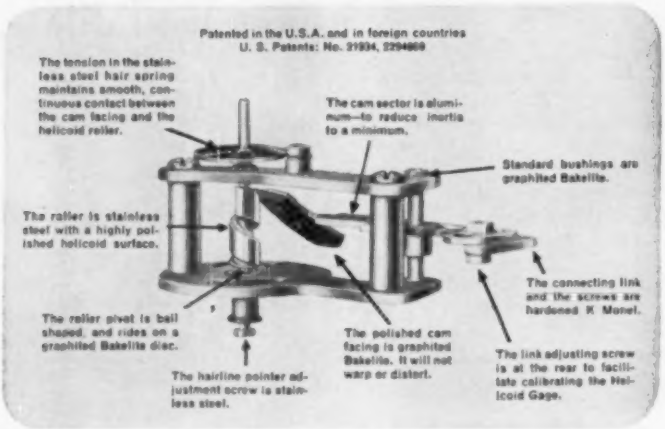
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was 300:1. The well was drilled to 5,872 ft., entering the Caddo lime at 5,167 ft., and the conglomerate at 5,351 ft.

WEST

Andrews County Wildcat Is Devonian Opener

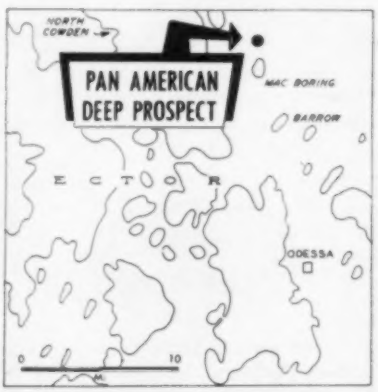
The Texas Co. 1 State "CE" in northeastern Andrews County has opened a new Devonian pool, or extended production from Northeast Andrews (Devonian and Ellenburger) field. Location in Section 19, Block 5, University Lands Survey, is approximately 1 mile north of the field.

The well made initial potential of 375.7 bbl. of 41-gravity oil a day through 33/64-in. choke, from 4 ft. of perforations between 12,514-19 ft. in the Devonian. Tubing pressure was 75 psi. and gas-oil ratio 618:1. Total depth was 12,527 ft. Lowest formation marker reported was the Wolfcamp at 9,810 ft., on elevation of 3,029 ft.

Third pay at Tripple N . . . A third pay zone has been added to the Tripple N field in southern Andrews County at Gulf Oil Corp. 1 BM State, Section 29, Block 9, ULS Survey. Gulf's well flowed 91 bbl. of oil in 25 hours through 10/64-in. choke from perforations in the Silurian at 10,581-10,716 ft. The well was then shut in for storage. It was originally completed in the Ellenburger.

Pan American Petroleum Corp. 2 University "BZ," discovery prospect 4 miles north of the Magutex field in northeastern Andrews County, continued testing. Acid treatment through perforations in the Devonian between 12,728-32 and 12,760-78 ft. produced

Deep Devonian Well Flows 5 Bbl. Per Hour



Pan American Petroleum 1 Fasken "I" flowed 5 bbl. of oil an hour from the Devonian at 11,540-90 ft. It also had good oil shows in the Fusselman at 12,270-12,320 ft. Nearest well in MacBoring field, to the south, is in the Wolfcamp.

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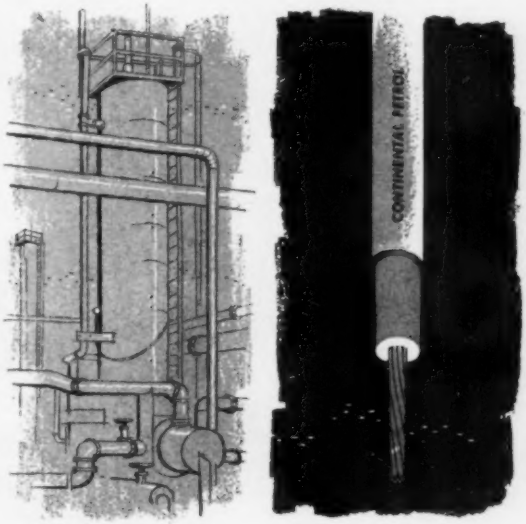

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Pecos County . . . Cities Service Oil Co. 1 Perry has opened a new Queen sand pool, or extended production to a recent discovery in the area 7 miles north of Sheffield field. No. 1 Perry completed on the pump for 99 bbl. of oil and 25 bbl. of water from perforations at 2,251-2,313 ft., following fracture treatment with 10,000 gal.

Deep test still drilling . . . Drilling was still under way at this report at Pan American Petroleum 1 University "CS," 13 miles southeast of Fort Stockton. Total depth was 20,776 ft. in shale, on Thursday, September 26.

SOUTHWEST

Fifth Pay Zone Opened In Monte Pasture Field

The steadily expanding Monte Pasture field in southern Kenedy County, got its fifth pay zone last week.

The new pay, a 4,000-ft. Miocene sand, was opened by The Texas Co. 14 Yturria, completed with open-flow potential of 29,000,000 cu. ft. of gas per day. Liquid (61.2°-gravity condensate) recovery was in the ratio of 281.9 M.c.f. per barrel.

The pay is perforated at 4,402-16 ft. Hole was drilled to 8,715 ft. Other sands proved productive so far are at 4,040 ft., 4,280 ft., 7,360 ft., and 8,430 ft. All are gas-productive. The field was discovered by The Texas Co. in August 1956.

Gonzales Wildcat Produces

A shallow Carrizo sand field has been opened 3 miles northwest of Smiley, in Gonzales County. Its discovery well, drilled by Mrs. James R. Dougherty at 2 Patteson Estate, in the Wade Horton Survey, is good for 48 to 50 tons of 19.5°-gravity oil per day on the pump. Pay is perforated at 1,387-92 ft.

GULF COAST

Second Oil Well Opens Third Hornbuckle Sand

Hornbuckle field, 7 miles northwest of LaWard, in southern Jackson County, is getting its second oil producer and another new zone with the completion of Midhurst Oil Corp. and Ogden & White of their 1 Mauritz Unit in a Frio sand, perforated at 7,209-15 ft.

The well is rated at 184 bbl. of

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clean oil per day, flowing through ⅛-in. choke under pressure of 1,235 psi. Flow is with gas-oil ratio of 470 cu. ft. per bbl. Gravity of the oil is 40.6°.

The field now has two gas wells in a 7,200-ft. sand, an oil well in a 7,360-ft. sand, and the new producer. The latter is about 1,000 ft. southeast of the field's gas-discovery well.

Sparta Gas Discovery At Millican Confirmed

Sparta gas production discovered in this Millican area of Brazos County last December is being confirmed by the area's second well.

The confirmation well, 1 Orlando, drilled by C. C. Winn, is 990 ft. southeast of Lone Star Producing Co.'s discovery well. The area is about 3½ miles northeast of the original Millican field.

The 2,600-ft. Sparta pay in Winn's well tested dry gas at the rate of 10,000,000 cu. ft. per day. Total depth is 2,654 ft.

PANHANDLE

New Pay Reported At Hansford Wildcat

Pan American Petroleum Corp. has reported discovery of a new formation and a good gas completion from two wells in the Texas Panhandle.

Pan American 1 Huff, located in Section 5, Block 1, A&GN Survey, Hansford County, was originally scheduled as an offset to Horizon Oil Co.'s 1 Buzzard, but the well became a wildcat with discovery of oil in the Cleveland sand.

Recovery from the Cleveland on a production test was 215 bbl. of oil in 10 hours through a ½-in. choke. Perforations were listed at 6,341-45; 6,382-85; and 6,396-6,401 ft.

Earlier, operator recovered gas at the rate of 5 million cubic feet a day on a production test of the lower Morrow, through perforations 8,188-99 ft. Well was drilled to a total depth of 8,300 ft., and operator temporarily plugged off at 6,460 ft. before testing the Cleveland.

Pan American has full interest in the well and about 2,500 acres in the immediate vicinity.

● Elsewhere in the Texas Panhandle, Pan American reported recovery of gas at the rate of 5,690,000 cu. ft. a day from the lower Morrow at its A-7 Lips Ranch wildcat. The well is located in Section 7, Block A, H&GN Survey, Roberts County.

Recovery was through perforations at 8,790-96 and 8,806-12 ft. with total depth reported at 9,110 ft., plugged back to 9,065 ft. Pan American has full interest in the well and in about 60,000 acres in the vicinity, including the total area of the Lips Ranch.

SUCCESSFUL WILDCATS

ALBERTA

Provo Naco 2-33-47-7 Hughenden, LSD 2, 33-40-7w4. TD 2,961 ft. basal quartz oil well.

Imperial 11-N Joffre. LSD 11, 1-39-27w4. TD 7,190 ft. D2 oil well.

Chamberlain N. W. 6-12-23-5 Bindloss, LSD 6, 12-23-5w4. TD 3,485 ft. Viking gas well.

BRITISH COLUMBIA

White & Lloyd Fargo 15 Blueberry, LSD 16, 14-88-25w6. TD 4,194 ft. Nikinassin gas well.

White & Lloyd Fargo 14 Blueberry, LSD 2, 30-88-25w6. TD 4,147 ft. Nikinassin gas well.

SASKATCHEWAN

White Rose Colorado 16-35 Pinto, LSD 16, 35-1-5w2. TD 5,600 ft. Charles oil well.

CALIFORNIA

Kern County: Union Oil Co. of California 26-17 KCL, NW NW 17-29s-27e, 162 BOPD, 19.6°-gravity, 10 per cent cut, 24/64-in. choke, perfs. 155 ft. of perfs. from 4,355 ft. plugged 4,360 ft., TD

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6,500 ft. (New pool discovery 1 mile west of Fruitvale field and 1½ miles northeast of Green Acres area.)

Shell Oil Co. 48-25 KCL, SE SW 25-11n-21w, 105 BOPD, 19 per cent cut, on pump, selectively perforated between 11,272-11,674 ft. TD 13,804 ft. (New field discovery 1 mile northeast of Pleito Creek oil field.)

NORTH LOUISIANA

DeSoto Parish: Petroleum, Inc. et al 1 Jasper Sharp, C NW NW NW 26-14n-12w. IPF 88 BOPD, 60 BW, 40.6° gravity. Tuscaloosa 2,637-42 ft. TD 6,782 ft. Discovery tentatively named Clear Lake pool.

Ouachita Parish: Arkansas Louisiana Gas Co. 1 S. W. Pipes, NE SW SW 33-18n-1e. IPF 1,147 BOPD, 53.8° gravity. Cotton Valley, Cadeville sand 9,121-24 ft. TD 9,241 ft. Discovery of new pay for Calhoun field.

SOUTH LOUISIANA

Jefferson Davis Parish: Texas Pacific Coal & Oil Co. 1 Louisiana Rice Milling, 41-9s-3w (2½ miles west of Jennings field). IP 1,850 M.c.f. daily and 11 BOPD, 5/32-in., 46.8°, TP 3,750 psi., perfs. 10,592-10,667 ft. TD 11,400 ft. (New field.)

Continental Oil Co. 2 Quatre Parish Co., 26-7s-7w. IP 1,100 M.c.f. daily, $\frac{1}{4}$-in., dry gas, TP 1,240 psi., perfs. 2,885-95 ft. TD 2,971 ft. (New pay in Thompson Bluff field.)

Lafayette Parish: Monsanto Chemical Co. 1 Bayou, 24-10s-5e. IP 302 BOPD and 3,000 M.c.f. daily, 5/32-in., 60°, TD 5,700 psi., perfs. 13,510-18 ft. TD 14,554 ft. (Second well and new pay in Broussard field.)

Lafourche Parish: Oil Gas Transmission Co. 1-A Harrison-Schultz Unit, 12-19s-23e. IP 4,200 M.c.f. daily, $\frac{1}{4}$-in., 32 BC per M.M.c.f., 56°, TP 4,100 psi., perfs. 13,280-90 ft. TD 13,382 ft. (New pay and extension in Coffee Bay field.)

Howell, Holloway & Howell 1 Peltier Unit, 162-14s-15e. IP 322.56 BOPD and 3,852 M.c.f. daily, $\frac{1}{4}$-in., 46°, TP 5,125 psi., perfs. 15,090-98 ft. and 15,102-41 ft. TD 17,212 ft. (New pay and second well in St. John field.)

Livingston Parish: A. J. Bankhead et al 1 Evans, 49-8s-3e (6 miles southwest of Denham Springs field). IP 76 BOPD, 5/32-in., 46°, GOR 1,289 cu. ft. per barrel, TP 475 psi., perfs. 9,709-13 ft. TD 10,080 ft. (New field.)

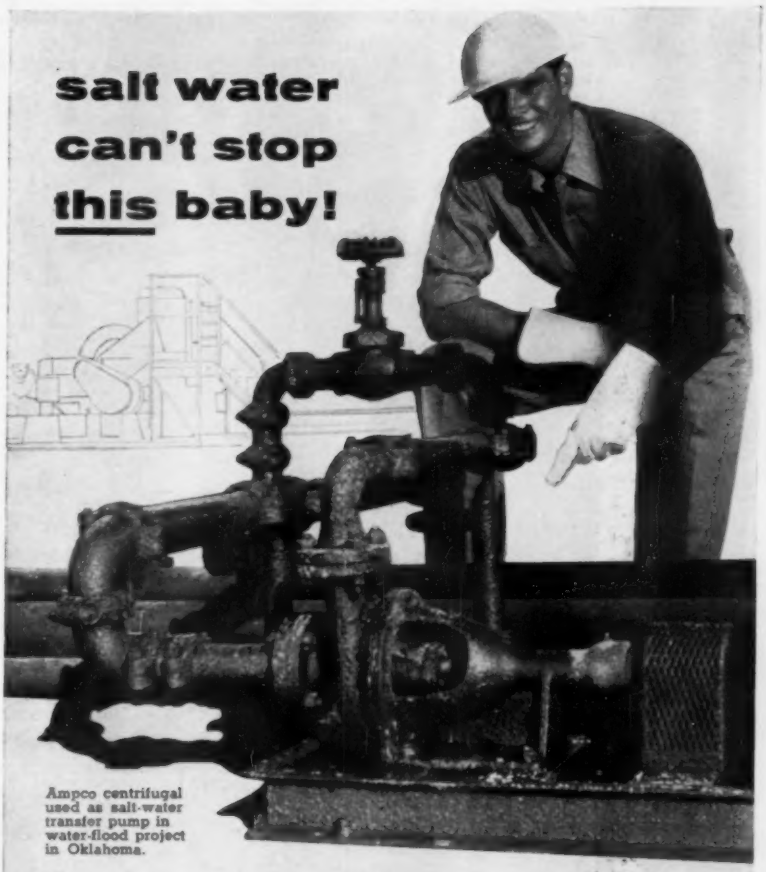
Plaquemines Parish: Richardson & Bass 1 Humble-R. F. Price et al, 30-19s-28e. IP 861 BOPD and 1,968 M.c.f. daily, ⅛-in., 39.7°, TP 10,700 psi., perfs. 19,151-74 ft. TD 20,186 ft. (Extends Lake Washington field—world's second deepest producer.)

California Co. 3 State Lease 3035, 21-19s-25e. IP 156 BOPD, 7/64-in., 35.4°, GOR 1,583 cu. ft. per barrel, TP 1,450 psi., perfs. 10,466-68 ft. TD 10,637 ft. (New pay in Saturday Island field.)

Tidewater Oil Co. 1-A Gilmore, 21-21s-28e. IP 189 BOPD, 7/64-in., 33.4°, GOR 3,614 cu. ft. per barrel, TP 3,750 psi., perfs. 13,792-98 ft. TD 15,604 ft. (New pay in Bastian Bay field.)

St. Charles Parish: California Co. 1 Craft et al Unit 1, 40-12s-9e. IP 5,150 M.c.f. daily, ¼-in., TP 3,412 psi., perfs. 10,192-10,202 ft TD 11,303 ft. (New pay in Kenner field.)

St. Martin Parish: Continental Oil Co. 3 Standard of Kansas, 82-10s-6e (1¼ miles northeast of St. Martinville field). IP 1,549 M.c.f. daily and 15 BOPD, 5/32-in., 48.5°, TP 3,300 psi., perfs. 9,063-71 ft., 9,084-9,118 ft., and 9,128-35 ft. TD



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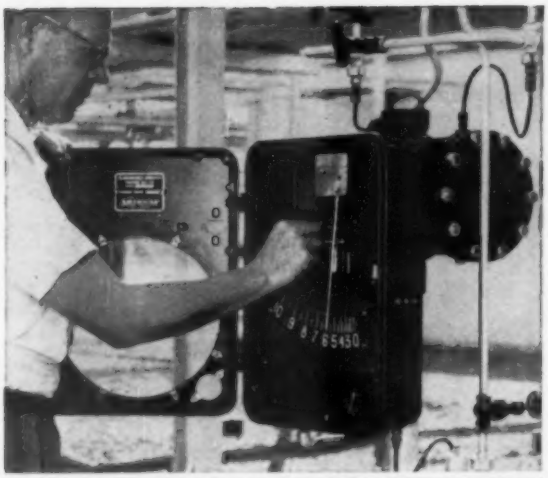

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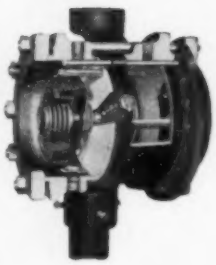

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13,600 (New pay and extension St. Martinville field.)

MICHIGAN

Saginaw County: Frank E. Roush and J. C. Voorhees 1 Ostrander SW NE SE 26-10n-3e, 24 miles southeast Porter field. IP 49 BOPD, 39°-gravity, Traverse lime 2,305-08 ft. TD 2,308 ft. Elev. 605 ft. (New pool.)

St. Clair County: Glen A. Mills 1 Watos, SE SW NW 22-4n-15e. IPF. 75 BOPD, 39°-gravity. Niagaran dolomite 2,547-52; 2,615-17 ft. TD 2,618 ft. Elev. 647 ft. (New pay in Peters gas field.)

NORTHWEST NEW MEXICO

Sandoval County: Humble Oil & Refining Co. 4 South Chaco Unit, NE SW SW 10-22n-8w. IPP 10 BOPD, 4 BWPD, Dakota discovery, new field. TD 5,855 ft. Morrison.

San Juan County: Royal Development Co. 1 Douthit, NW SE SE 33-28n-13w. IP 5,229 M.c.f. of gas per day, Dakota discovery, new field. TD 6,400 ft. Morrison.

MISSISSIPPI

Adams County: Marlin Exploration Co. 1 Pierce Butler, 15-5n-3w. IP 288 BOPD, ¼-in., 43.6°, GOR 300 cu. ft. per bbl. TP 280 psi., perforations 6,663-66 ft. (Wilcox-Parker sand). TD 6,812 ft. Elev. 272 ft.. Wilcox 4,740 ft., base Big shale 6,074 ft., Parker sand 6,663 ft. (New field—Ellis Cliffs.)

OKLAHOMA

Tillman County: Ambassador Oil Corp. 1 Cora Oaks, C SE SW SE 32-2s-18w. IPP 100 BOPD, 41° gravity, Strawn congl. 5,029-76 ft. TD 5,390 ft.

Love County: Gilmer Oil Co. 11 T. A. Malone, SW 20-6s-2e. IPF 497 BOPD, Malone 3,751-78 ft., Vestal 4,740-70 ft. TD 4,830 ft. New pay (Malone) in Northeast Greenville pool.

Coal County: Atlantic Refining Co. 1 A. D. Cody, NE NE 25-3n-9e. IP 24,600 M.c.f. of gas per day, Wapanucka 3,574-3,678 ft. TD 7,500 ft. New pay in Chiles Dome pool.

Beaver County: Cities Service Oil Co. et al 1 Fickel "B," NE NE SW 17-3n-25eCM. IP 1,940 M.c.f. of gas per day, Chester-Miss. 7,435-40, 7,468-88 ft. TD 7,620 ft. New pay for Northwest Camp Creek pool.

Cities Service et al 1 Ferguson "D," SW SW NE 18-3n-25eCM. IP 867 M.c.f. of gas per day, Morrow-Penn. 7,101-03, 7,114-26, 7,384-7,407 ft. TD 7,700 ft. New pay in Northwest Camp Creek pool.

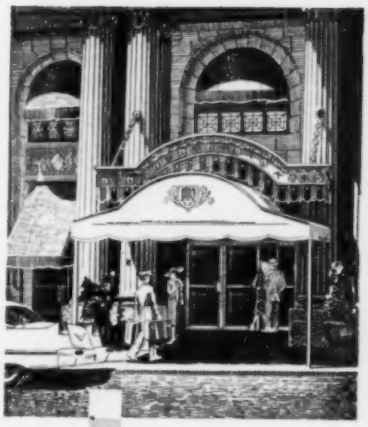
McClain County: Chester H. Westfall Drilling Co. 1 Jordan, SW 5-5n-3w. IPF 618 BOPD, Hart 8,450-94 ft., Hunton 9,176-97 ft. TD 10,412 ft. New pay (Hart) in North Payne pool.

Weimer & Fitzhugh 1 Fred Fry, SE SW 19-5n-2w. IPF 268 BOPD, 36° gravity. Hart 7,157-7,236 ft. TD 8,281 ft. Discovery of East French pool.

Hughes County: R. G. Scott 1 Calvin Unit-Brown, NW 8-5n-10e. IP 6,664 Mc.f. of gas per day, Cromwell 4,406-07 ft. TD 6,745 ft. New pay in South Calvin pool.

Beaver County: Ambassador Oil Corp. et al 1 State of Oklahoma, 14-6n-22eCM. IP 2,750 M.c.f. of gas per day, Marmaton 5,503-06 ft. TD 6,596 ft. New pay in Northeast Greenough pool.

Kiowa County: Carter Oil Co. et al 1 Maude McDonald, C NW SE SE 16-7n-14w.



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IP 6,220 M.c.f. of gas per day, Simpson 3,330-85 ft. TD 5,110 ft.

Beckham County: Shell Oil Co. et al 1 C. Boyd Unit, C NW NW 15-9n-22w. IPF 4,126 M.c.f. of gas per day, 77 bbl. distillate. Springer 10,114-74 ft., 10,212-65 ft. TD 12,998 ft.

Logan County: J. A. Chapman 1 Albert G. Briscoe, C SW NE 33-15n-1e. IPF 480 BOPD, 42° gravity, Checkerboard 4,123-33 ft. TD 4,220 ft. Discovery of South Garden pool.

Lincoln County: Hubbell Drilling Co. 1 Graham, NE NW SE 35-15n-6e. IP 9,000 M.c.f. of gas per day, Barts. 3,419-31 ft. TD 3,730 ft. New pay in North Key West pool.

Noble County: Atmar Drilling Co. 1 Gertrude, NE 31-20n-1w. IPF 96 BOPD, 40° gravity. Misener sand 4,979-89 ft. TD 5,133 ft. New pay in Orlando Middle pool.

Woodward County: Shell Oil Co. 1 Garvis, NE 26-22n-17w. IP 5,400 M.c.f. of gas per day, 25 BOPD, 56° gravity, 5 BWPD, Chester 7-236-7,313 ft. TD 7,450 ft.

Garfield County: Champlin Oil & Refining Co. 1 Johnson, SE SE SE 29-23n-5w. IPP 62 BOPD, 32 BWPD, 44.2° gravity. Wilcox 6,779-85 ft. TD 6,924 ft. Discovery of Breckenridge pool.

Grant County: Caulkins Oil Co. 1 Phillips, SW SE SW 33-26n-3w. IPF 779 BOPD, Layton 3,818-28 ft., Wilcox 5,180-85 ft. TD 5,277 ft. New pay in Lamont pool.

COLORADO

Garfield County: National Associated Petroleum Co. 1-A Federal, SE SE SW 22-7s-104w. IP 3,700 M.c.f. of gas per day, Buckhorn discovery, new field. TD 4,193 ft. Morrison.

Logan County: L. J. Williamson 1 Ha'l, NW SW 15-6n-53w. IPF 264 BOPD, "D" sand 4,529-34 ft. TD 4,645 ft. Discovery of Elm Grove field.

Moffat County: Skelly Oil Co. 1 H. W. Chorne, 24-12n-101w. IP 13,000 M.c.f. of gas per day, Fort Union 4,633-37 ft., Lance 4,667-4,763 ft. TD 4,763 ft. Extension to West Hiawatha pool.

LaPlata County: Murchison Trusts 1-29 Blk. 9, 29-33n-10w. IP 3,197 M.c.f. of gas per day, Mesaverde 5,616-6,550 ft. TD 6,650 ft. Extension to Ignacio pool.

NEBRASKA

Banner County: Columbine Exploration Co. 1 Burnett, C NE SE 7-18n-53w. IPP 33 BOPD, "J" sand discovery, new field. TD 5,459 ft. Skull Creek.

McDaniel Drilling Co. 1 Brown, C NE SE 11-18n-54w. IPP 288 BOPD, "J" sand discovery, new field. TD 5,430 ft. "J" sand.

WYOMING

Natrona County: Batzer Oil Corp. 3 Government, 20-31n-82w. IPP 25 BOPD, 38° gravity, Steele 2,385-2,406 ft. TD 2,441 ft. New field.

Big Horn County: Colorado Oil & Gas Co. 1-X Government, 9-55n-96w. IPP 75 BOPD, 23.6° gravity. Phosphoria 6,264-6,312 ft. TD 6,797 ft. Discovery of Southeast Bryon pool.

Sohio Petroleum Co. 3 Alkali Anticline, 32-55n-95w. IPP 230 BOPD, 21 and 25.8° gravity. No other data. Discovery of Alkali Anticline field.

MONTANA

Hill County: The Texas Co. 1 Bradbury, C NE NE 10-33n-9e. IP 2,980 M.c.f. of gas per day, Sawtooth 3,384-3,421 ft. TD 3,585 ft.

Musselshell County: Continental Oil Co. 1 Lind, SW NE 5-8n-26e. IPP 7 BOPD, 75 BW, 35.5° gravity. Amsden 6,124-50 ft. TD 6,510 ft.

NORTH DAKOTA

Bottineau County: Max Bass Natural Gas Co. 1 Leslie Romine, SE NE SW 35-161n-81w. IPF 10 M.c.f. of gas per day, gas discovery, new field. TD 184 ft.

Burke County: Hunt Oil Co. 1 Melvin E. Peterson, C SW NW 8-159n-94w. IPF 61 BOPD, 2 BW, 43° gravity. Iverson 7,897-7,913 ft. TD 8,022 ft. New field.

McKenzie County: Amerada Petroleum Corp. 1 Bear Den Unit, NW NE SE 25-149n-96w. IPF 146 BOPD, 22 BWPD, 14/64-in. choke. Madison discovery, new field. TD 9,844 ft. Madison.

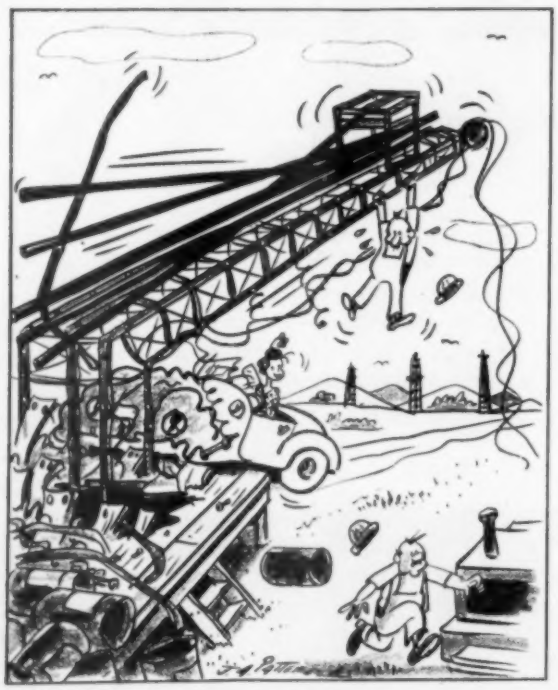
WEST CENTRAL TEXAS

Callahan County: Champlin Oil & Refining Co. 1 Smith, Sec. 33, BBB&C Sur., 1½ miles east of Eula. IPP 50 BOPD, 38°-gravity, GOR 850, Cook sand 1,816 ft. TD 2,183 ft.

Shackelford County: Jim B. Curry et al 1 Ivy, W. S. Keaghey Sur. 2, 2 miles north Lueders. IPP 24 BOPD, 37°-gravity, GOR 150, Tannehill sand 1,468-75 ft. TD 3,305 ft.

TEXAS GULF COAST

Kenedy County: The Texas Co. 14 Yturria-NCT-1 San Juan de Carricitos Grant, A-8 (11 miles northeast of Raymondville). IP 29,000 M.c.f. daily, open-flow potential, GLR 281.9 M.c.f. per bbl., 61.2°, shut-in tubing pressure 1,844 psi., perforations 4,402-06 ft. (Miocene). TD 8,715 ft. (New pay in Monte Pasture field.)



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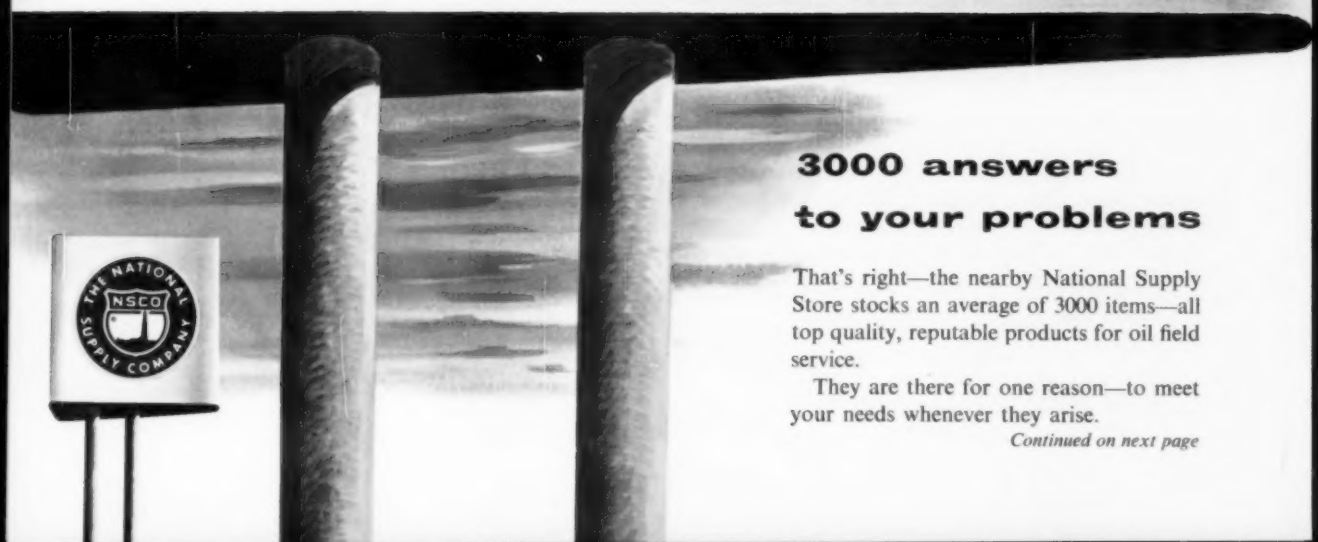

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Continued from preceding page

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NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT

SPANG STEEL PIPE AND ELECTRICAL CONDUIT

A veteran Gulf pipeliner . . .

. . . Wilkins Boss For Laurel Job

THE MAN WHO'LL direct building the $50-million Laurel pipeline is William J. Wilkins, a veteran pipeliner for Gulf Oil Corp.

Wilkins' election as president of Laurel Pipe Line Co. was announced last week. His executive staff will include R. D. Jackson, Jr., vice president and secretary; M. W. Ramsey, vice president; C. C. Johns, assistant secretary; D. M. Hughes, assistant secretary; and Peter Affeld, assistant treasurer.

The new line will be a products carrier moving refined petroleum 440 miles from the Philadelphia refining area west to Cleveland (OGJ, May 13, p. 91). Initial capacity will be 100,000 bbl. daily with pipe size varying from 24-in. to 14-in. Work will start early next year.

Gulf will own 40 per cent of the joint venture with Sinclair Pipe Line Co. holding 35 per cent, and The Texas Co. 25 per cent. Members of the board of directors representing the three owners include: Wilkins, J. L. Irvin, Jackson, and Ramsey for Gulf; G. H. Giles, K. T. Feldman, and D. S. Purnell, Sinclair; and F. M. Dawson and J. W. Emison, Texaco.

The chief . . . Wilkins, the new boss of Laurel, has been pipeline coordinator for Gulf since 1950.

A graduate of Aliquippa, Pa., high school and the University of Pittsburgh, Wilkins now resides at Mount Lebanon, near Pittsburgh. But his service in the oil industry has included long tours of duty in West Texas, Oklahoma, and the Middle East.

While studying for his petroleum engineering degree, Wilkins worked for Marland Oil Co. in Oklahoma during summer vacations. Upon graduation in 1926, he went with Marland as assistant petroleum engineer at Ponca City, Okla. Later he was transferred to West Texas as division engineer.

Wilkins joined the Gulf organization in 1929 as mechanical engineer and 10 years later was named chief engineer of the company's Tulsa pipeline division. In 1948 he went to Kuwait where he spent several months as executive assistant to the general manager of Kuwait Oil Co., Ltd. He supervised general pipeline construction.

On his return to the United States, Wilkins moved into Pittsburgh where he joined Gulf's transportation department, ultimately being promoted to chief of transportation branch and then pipeline coordinator. In addition Wilkins has served as a director of Interprovincial Pipe Line Co. while that line was being built in Canada and has been an officer and director of other companies in which Gulf has an interest.

WILLIAM J. WILKINS
. . . construction jobs are up his alley.

The new line . . . The Laurel line will meet a products pipeline need existing in this area for some time.

Pipeline space has been at a premium both moving west from Philadelphia and east from Chicago. The line will run west out of Philadelphia to Pittsburgh and then swerve northwest to Youngstown and Cleveland, supplying a heavy marketing area with products.

The initial 100,000-bbl. daily capacity can be increased if demand grows by adding horsepower to the four stations now planned or adding new stations.

Ted Waibel, Jr., Sinclair Oil & Gas Co. junior petroleum engineer, has been transferred to Tulsa from Nowata, Okla.

E. H. Sloyer, R. W. Rine Drilling Co., has been elected chairman of the Kansas regional chapter of American Association of Oilwell Drilling Contractors. Other officers are **Hi Lewis,** vice chairman; **E. L. Gamble,** treasurer; **Jack Youngling,** secretary; and **Wendall Peel,** vice chairman for western Kansas.

Personals

Edward W. Upton has been elected vice president of Refinery Engineering Co. Upton joined Treco in March as executive assistant to the president.

James R. Burton has joined The Texas Co.'s Port Arthur, Tex., research and development laboratories as a chemist. Burton is a recent graduate of Texas Technological College.

Richard T. Peterson, Robert R. Riggs, and **Ralph J. Weling** have been named to the refinery technology division of Ethyl Corp.'s Detroit research laboratories.

John Curtis Thrash, Jr., has been promoted to district petroleum engineer in Oklahoma City by British-American Oil Producing Co. He was formerly senior staff engineer for the company in Dallas.

John P. McCabe, area superintendent for Tidewater Oil Co. in Ventura, Calif., has been promoted to assistant to **J. E. Gray,** head of foreign exploration and production. McCabe has been transferred to San Francisco.

Charles L. Matthews, district geologist for Republic Natural Gas Co. in Wichita, has been transferred to Denver. **Jack P. Davidson,** geologist, has been transferred to Hugoton, Kans., from Wichita. Republic's Wichita office will close October 15.

H. D. Moore has been elected a vice president of Sinclair Oil Corp. He will be executive assistant to the executive vice president for operations and will coordinate activities of Sinclair's newly acquired refining, transportation, and production interests. Moore was with the W. T. Waggoner Estate before joining Sinclair in 1950. He was assistant general manager of wholesale sales for Sinclair Refining Co. before his promotion to vice president of the parent company.

Charles F. Van Berg, manufacturing manager of International Petroleum (Colombia), Ltd., has been appointed petroleum economics advisor in the Coral Gables, Fla., executive office of International Petroleum Co., Ltd. **Bryson M. Filbert**, manufacturing coordinator for International, will transfer to Colombia to succeed Van Berg.

Personals

M. D. HAYNES

M. David Haynes, superintendent of crude, coking, and cracking at Tidewater Oil Co.'s Delaware City refinery for the past year, has been named refinery superintendent. He will be in charge of all oil processing operations at Delaware. **Clifford A. Phillips,** supervisor of the desulfurization and hydrogen area at the refinery, will succeed Haynes as superintendent of crude, coking, and cracking. In other appointments at the new refinery, **Glenn W. Wimberly** has been named supervisor of the desulfurizing and hydrogen area, succeeding Phillips. **William E. Baston** becomes technical foreman, reforming and extraction area, replacing Wimberly. **John M. Wright,** assistant engineer in the technology group, moves up to staff engineer, reforming and extraction area, succeeding Wright. Haynes, the new superintendent, has been with Tidewater since 1929. He was chief process design engineer at the company's Bayonne, N. J., refinery before being transferred to Alhambra, Calif., in 1955 as part of a group supervising design of the Delaware refinery.

Harry N. Stamper, assistant chief civil engineer for Humble Oil & Refining Co., has moved up to chief civil engineer. He succeeds **S. W. Oberg,** who has retired. **William A. Castille,** division engineer in Houston, will replace Stamper.

Elster A. Smith, assistant manager of Lone Star Gas Co.'s gas supply department since 1954, has moved up to manager. He will also head Lone Star Producing Co.'s exploration and gas supply division. Smith succeeds the late J. Paul Rogers.

E. R. Rowzee, vice president and manager of Polymer Corp., has been elected president and managing director. Rowzee succeeds **J. D. Barrington,** who resigned to become president and managing director of Ventures, Ltd. Rowzee, a graduate of Massachusetts Institute of Technology, has been with the Canadian firm since 1942 and has been vice president and manager since 1951. Barrington will continue as a director of Polymer. As president of Ventures, Ltd., Barrington succeeds **Robert Anderson,** who left the Canadian company recently to become Secretary of the Treasury.

R. H. Feierabend has been promoted by Freeport Sulphur Co. from general superintendent in Port Sulphur, La., to assistant vice president in New Orleans.

James G. Mitchell, formerly with the United States Air Force petroleum quality control laboratory at Searsport, Me., has joined Tidewater Oil Co. as laboratory coordinator at Delaware City, Del.

James W. Badie has joined Socony Mobil Oil Co.'s refining section, process engineering division, in Paulsboro, N. J. He was formerly with Stauffer Chemical Co.

Harry Rayson Lester, northern area gas superintendent for Saskatchewan Power Corp., has been promoted to provincial gas distribution superintendent. He will supervise all gas distribution systems in Saskatchewan for the company.

A. C. Austin, Ohio Oil Co., has been appointed vice president of the Casper, Wyo., Geophysical Society. He succeeds **R. L. Zieve,** Pan American Petroleum Corp., who has been transferred from Casper to Billings, Mont.

Alex G. Oblad, vice president and a director of Houdry Process Corp., has joined M. W. Kellogg Co. as a vice president. Oblad will be in charge of Kellogg's research and development. He formerly had been with Texas Research Foundation, Magnolia Petroleum Co., and Standard Oil Co. (Ind.). Oblad is a director of the International Congress on Catalysis and editor of publications for the American Chemical Society's division of petroleum chemistry.

John P. Dearasaugh, vice president of Lavaca Pipe Line Co., subsidiary of Aluminum Co. of America, has retired. Dearasaugh has been with Alcoa since 1920, and has been vice president of Lavaca since 1949.

Paul L. Kelly, Calvert Drilling, Inc., has been elected president of North Dakota Oil and Gas Association. Vice presidents are **Bruce P. Alfson,** independent; **W. E. Sloan,** Ohio Oil Co.; **W. R. Strickland,** Skelly Oil Co.; and **Thomas W. Leach,** independent. **Clifford Jansonius,** Strutz, Jansonius & Fleck, is secretary; **Evan D. Saltzman,** treasurer; and **Allan Eastman,** executive director.

Herbert C. Otis, Sr., chairman of the board of Otis Engineering Corp., Dallas, has been named as first recipient of the John Franklin Carll award of the Society of Petroleum Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers. The award will be presented October 7 at an A.I.M.E. meeting in Dallas. The citation will read: "In recognition of his creative and practical contributions to petroleum engineering in harnessing reservoir energies for safer and more efficient production of petroleum." Otis is given credit for originating the system of running pipe under pressure in oil and gas wells. He also originated the first square kelly drilling head for drilling-in of wells under pressure; first removable bottom-hole choke; first removable subsurface regulator which could be placed in the tubing flow stream of a well; and many others.

O. Q. Lomax, who retired recently as president of Humble Pipe Line Co., has been elected a director and special pipeline consultant of Sharman, Allen, Gay & Taylor, Inc., Houston contractors.

J. M. Evans, assistant vice president, engineering, for Standard Oil Co. of California, has retired. Evans joined Socal in 1915. He was chief engineer and chairman of the board of engineers before becoming assistant vice president last year.

Ira H. Cram, senior vice president of Continental Oil Co., has received an Outstanding Achievement Award for distinguished engineering graduates from the University of Minnesota. He has a bachelor's and master's degree from the university.

William F. Lowe, secretary-treasurer of Natural Gasoline Association of America since 1934, has been appointed executive director and treasurer. **Ronald E. Cannon,** formerly technical editor for McGraw-Hill Publishing Co., has been named N.G.A.A. secretary.

Homer H. Dedo has been named automotive consultant for Standard Oil Co. (Ohio). He will headquarter in Detroit. Dedo was formerly a consultant and section supervisor in the company's manufacturing department, Cleveland. He was director of automotive research for Ethyl Corp. before joining Sohio in 1954.

A. N. Horne Receives A.S.M.E. Award

Albert N. Horne, left, vice president and general manager of Texaco-Cities Service Pipeline Co., was honored by American Society of Mechanical Engineers by being named a Fellow in the society. The award was made by W. H. Stueve, right, Oklahoma City consultant, at A.S.M.E.'s recent petroleum mechanical engineering conference in Tulsa. Horne has been associated with many of the largest pipeline projects in the industry. During World War II he was general manager in charge of final construction of the Big Inch and Little Big Inch lines. He directed construction of Basin Pipe Line System in the late 1940's. He was general manager and vice president of Trans-Arabian Pipe Line Co. when Tapline was constructing its main line, and later was president of Trans-Northern Pipe Line Co.

Donald G. Fine has joined The Texas Co. as chemical engineer in the company's Port Arthur research and development laboratories.

John Thompson has joined **H. L. Hunt,** Dallas independent, as superintendent of Hunt's Clear Creek natural-gasoline plant, Reeves, La. Thompson was formerly operations superintendent for Texas Gas Corp., in Winnie, Tex.

Jess E. Hendricks has joined Coastal States Gas Producing Co. as manager of operations. He will supervise Coastal States' gathering systems and production. Hendricks was formerly manager of gas, gasoline, and refining departments for **H. L. Hunt,** Dallas independent.

G. J. Kohler, Jr., has been named manager of Latin American operations for Geophysical Service, Inc. G. S. I.'s four regional operations managers in Latin America will be **Rodolfo Martin,** Mexico; **C. J. Spivey,** Venezuela; **P. S. Stoutjesdyk,** Brazil; and **D. W. Rockwell,** Andes region. Appointed supervisors were **John Donna,** Mexico; **H. L. Heggy** and **P. E. Swansen,** Brazil; and **Murrell Holbert,** Andes region.

Robert G. Newell has been named assistant manager of the manufacturing division of Dutton-Williams Brothers, Ltd., in Edmonton. Newell has been with Dutton-Williams in Calgary for the past year. He was chief engineer of Unifin Tube Co. before that time.

Charles J. Boyce, intermediate petroleum engineer with Pan American Petroleum Corp., has been transferred to Worland, Wyo., from Brush, Colo.

L. F. ELKINS

L. F. Elkins has been appointed to the new position of manager of production research for Sohio Petroleum Co. Sohio set up its research unit October 1. Elkins has been technical adviser to the general manager of the company for the past few months. He was chief engineer before that time. Also assigned to the new unit are **John Bemrose,** senior research geophysicist; **Lynn Jacobsen,** senior research geologist; **J. E. Berryman,** senior research engineer; **R. J. McIntyre,** research mathematician; and **T. L. Irby,** research engineer.

Personals

Jack Sanders has been named Rocky Mountain regional geologist for Continental Oil Co. He succeeds **Bruce Curtis,** who has resigned. Sanders was formerly assistant regional geologist.

Cliff Nolte, exploration manager in Denver for Sterling Drilling Co., has resigned to open consulting offices there. He will continue as consultant with Sterling.

G. C. Colwell, a director of Parker Drilling Co., has been elected a vice president. **W. E. Snell** has also been elected vice president and a director of the company.

DEATHS

R. C. Baker, 85, founder and chairman of the board of Baker Oil Tools, Ltd., died September 29 in Whittier, Calif. Baker stepped down as president of the equipment firm in April. A pioneer in California's oil industry as an independent and a drilling contractor shortly after the turn of the century, Baker introduced the first rotary drilling equipment in the Coalinga area in 1907. In 1912 he formed Baker Casing Shoe Co., which later became Baker Oil Tools. The company began with three employes, later grew to a world-wide organization employing around 1,400.

Earl Huhn, 49, Pan American Petroleum Corp., died October 1 in Calgary. A graduate of the University of Tulsa, Huhn had been with Pan American, then Stanolind Oil & Gas Co., since 1929. He transferred to Calgary from Tulsa in 1948.

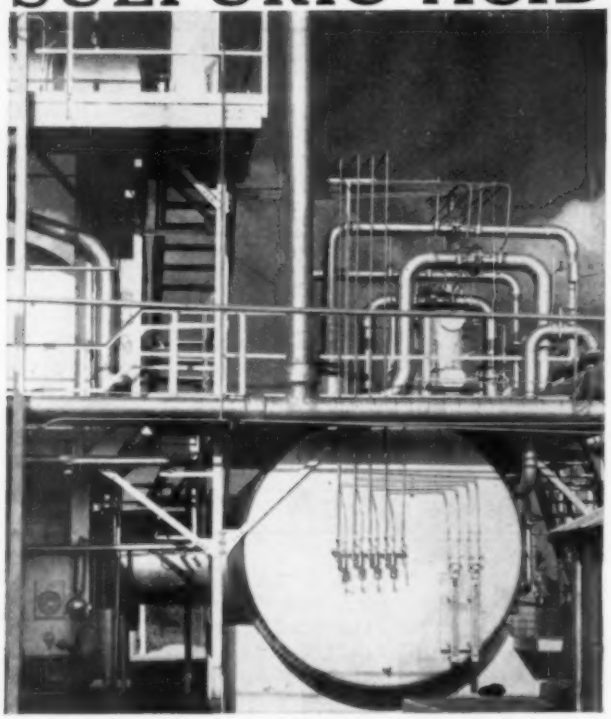
Jacob R. (Jake) Phillips, 76, Borger, Tex., driller and producer in Texas and Oklahoma, died September 25 in Borger after a long illness.

Arthur F. Mewburn, vice president and a director of Central-Del Rio Oils, Ltd., died September 22 in Edmonton after a long illness.

Jon Paul Jones, 45, vice president of Ranger Petroleum Co., Tulsa, died September 30 in East Lansing, Mich., after a heart attack. Jones left a professional stage career to enter the oil business 3 years ago.

Charles Lee Tucker, 44, Pittsburgh, coordinator in Gulf Oil Corp.'s transportation division, died September 28.

SULFURIC ACID



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Hexamine
Hydrazine and Derivatives
Hypochlorite Products
Methanol
Muriatic Acid
Nitric Acid
Polyamines
Soda Ash
Sodium Chlorite Products
Sodium Methylate
Sodium Nitrate
Sulfate of Alumina
Sulfur (Processed)
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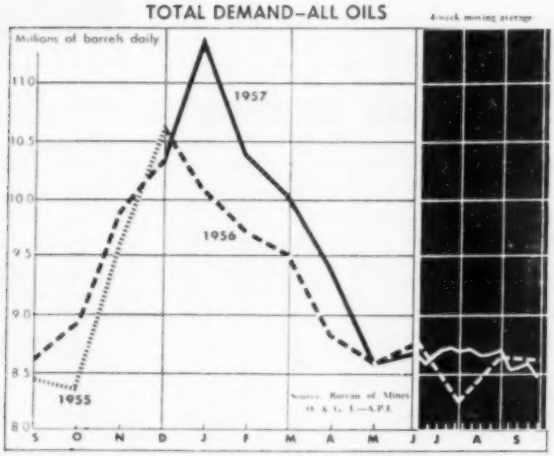
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,834,400	DOWN	16,400	DOWN	215,370
Crude stocks	283,165,000	UP	1,609,000	UP	8,562,000
Completions	1,147	UP	61	UP	112
Refinery runs	7,918,000	UP	88,000	UP	6,000
Gasoline stocks	177,430,000	UP	3,372,000	UP	2,710,000
Kerosine stocks	36,331,000	UP	141,000	UP	2,514,000
Distillate stocks	169,265,000	UP	3,503,000	UP	18,898,000
Residual stocks	57,716,000	UP	1,713,000	UP	10,217,000
Four-product stocks	440,742,000	UP	8,729,000	UP	34,339,000
Total imports	1,359,600	DOWN	142,300	DOWN	207,400

TOTAL DEMAND—ALL OILS



Gasoline Output for Past 4 Weeks Was 300,000 Bbl. Daily Above July

THE TYPICAL REFINER is taking a daily look at his hole card. He is watching the dwindling space in his clean storage tanks. Clean-product stocks normally reach a peak about the end of October.

Last year, gasoline stocks dropped to the low point for the season the same week that stocks of middle distillates reached a peak. This was on November 9. The total at that time for both gasoline and middle distillate was 369,604,000 bbl.

Total stocks of gasoline and middle distillate topped 283,000,000 bbl. on September 27 this year with at least 4 weeks to go before the date of the normal peak.

Gasoline stocks started climbing this year after reaching a low point of 171,683,000 bbl. on August 30. At that time, the gasoline-stock total was 3,888,000 bbl. under the previous year. Four weeks later, total gasoline stocks showed a gain of 2,710,000 over last year.

A slight decline in over-all gasoline demand contributed to the shift in stock position, but the major cause was the boost in refinery runs and gasoline production. Gasoline production averaged 4,094,000 bbl. daily for the 4-week period ended September 27 compared with 3,777,000 bbl. daily for the 4-week period ended July 27. From these averages, we see that gasoline production in recent weeks has been 300,000 bbl. daily higher than in July, normally the peak of the motoring season.

Part of the gasoline-stock shift has been due to gains in California. On August 30, gasoline stocks on the West Coast showed a gain of 3,850,000 bbl. over the previous year. The total for the remainder of the country was down 7,738,000 bbl.

For September 27, West Coast gasoline stocks were up 4 201,000 bbl. from last year, and the decrease for all other districts had been cut to 1,491,000 bbl.

In general, gasoline markets tend to reflect stock positions in both the marketing area and in any district supplying the marketing area.

Gasoline markets tend to be firm in the Mid-Continent and North Central districts. Gasoline stocks for this district are down 3,624,000 bbl. from last year. On the other hand, a gain of only 1,671,000 bbl. for the Gulf-East Coast districts is showing up as soft gasoline markets. Of course, many suppliers believe that last year's gasoline stocks in these districts were too high.

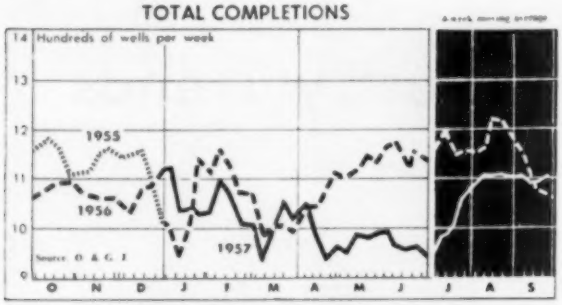
Stocks of middle distillate are 21,412 000 bbl. higher than last year. This represents a gain of 10.4 per cent. Even with the full heating season ahead, this excess is adding to the pressure on distillate markets.

Summer discounts on the East Coast normally are removed at the end of September. This year, most of the marketing companies have moved the date to October 31. There are rumors of additional discounts in some of the high-demand areas on the East Coast.

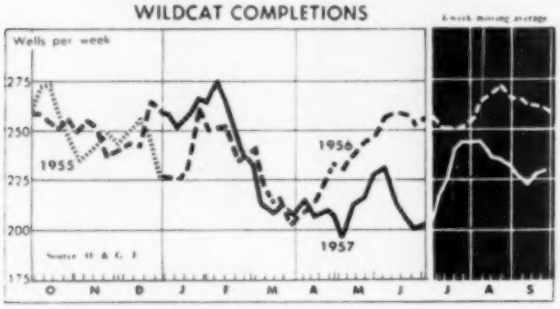
This market weakness is showing up in eastern Canada. Imperial Oil, Ltd., announced a cut of 0.5 cent a gallon on kerosine, stove oil, diesel fuel, and light furnace oils for eastern Canada.

Ohio Oil Co. announced a reduction in prices paid for heavy sour crude in Wyoming. The cut was 8 cents a barrel, effective October 1. The Wyoming listing on page 281 has not been changed since some buyers have not announced new prices. Indiana Oil Purchasing Co. cut Arkansas crude 10 cents a barrel, also effective October 1. Additional information on these price changes is carried in the news section.

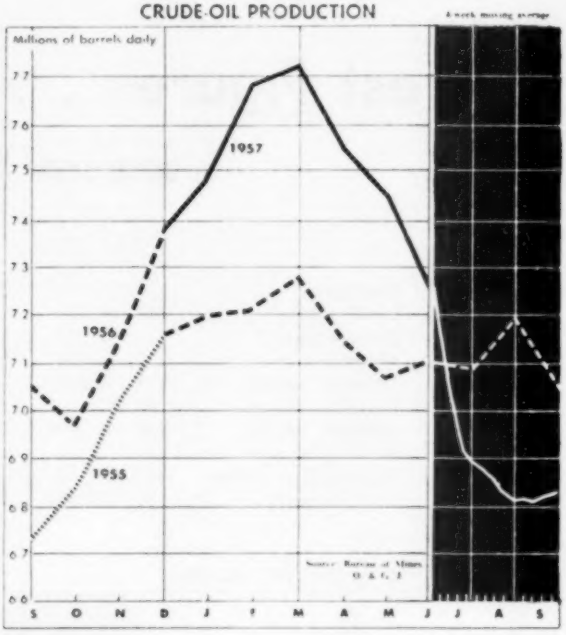
TOTAL COMPLETIONS



WILDCAT COMPLETIONS



CRUDE OIL PRODUCTION

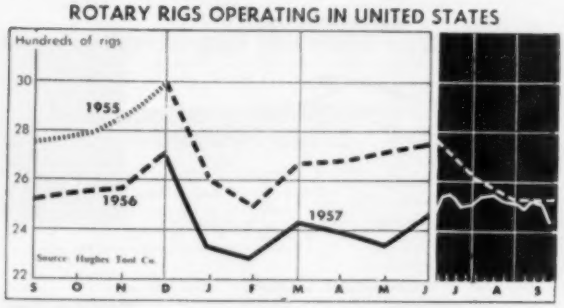


WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 28, 1957

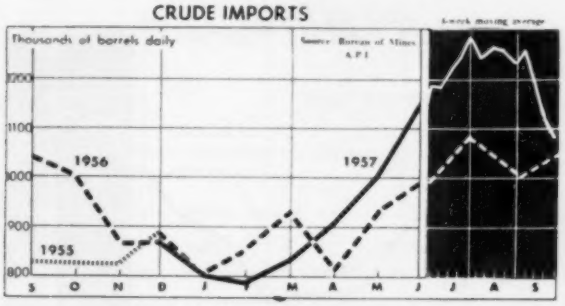
	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1957	1956	Total	Crude	Cond.	Gas	Dry	1957	1956
Alabama	1	1	0	0	0	0	11,500	65	‡81	0	0	0	0	0	20	‡36
Arkansas	19	11	0	0	8	0	67,105	826	676	3	0	0	0	3	149	142
California	57	40	0	0	17	0	269,777	1,623	1,656	16	2	0	0	14	394	397
Colorado	11	4	0	1	6	0	59,384	629	886	5	0	0	0	5	417	473
Illinois	61	33	0	1	27	0	152,855	1,940	2,871	10	1	0	0	9	479	557
Indiana	17	4	0	0	13	0	28,737	480	504	1	0	0	0	1	93	103
Kansas	83	36	0	4	42	1	311,101	3,117	3,757	21	2	0	0	19	628	805
Kentucky	36	9	0	8	19	0	58,094	1,093	1,383	6	0	0	0	6	225	319
Louisiana	76	27	9	6	34	0	610,902	2,838	2,854	17	0	1	3	13	504	568
North	27	17	0	2	8	0	90,714	1,013	1,240	1	0	0	0	1	133	189
South	35	4	9	1	21	0	375,697	1,311	1,297	12	0	1	0	11	307	321
Offshore	14	6	0	3	5	0	144,491	514	317	4	0	0	3	1	64	58
Michigan	7	5	0	2	0	0	17,660	316	330	2	2	0	0	0	112	130
Mississippi	11	3	0	0	8	0	77,420	293	335	7	1	0	0	6	153	164
Montana	6	4	0	0	2	0	40,243	305	341	2	0	0	0	2	119	124
Nebraska	24	6	0	0	18	0	155,752	655	739	12	1	0	0	11	362	360
New Mexico	40	28	0	6	6	0	197,515	1,588	1,453	2	0	0	0	2	208	197
Northwest	12	4	0	5	3	0	56,444	647	626	1	0	0	0	1	78	66
Southeast	28	24	0	1	3	0	141,071	941	827	1	0	0	0	1	130	131
New York	9	4	0	0	0	5	9,250	344		0	0	0	0	0	6	
North Dakota	5	4	0	0	1	0	27,698	199	191	4	3	0	0	1	91	58
Ohio	24	8	0	8	6	2	56,550	829	768	1	0	0	0	1	10	9
Oklahoma	149	88	1	6	43	11	566,778	4,668	6,307	22	5	0	1	16	546	670
Pennsylvania	13	0	0	11	2	0	90,703	486	†766	0	0	0	0	0	39	†20
Texas	459	283	16	16	141	3	1,850,647	16,277	16,666	87	14	3	2	68	3,909	4,244
District 1	20	11	5	0	6	0	60,488	932	*2,388	4	0	1	0	3	317	*816
District 2	18	8	1	2	7	0	96,171	572	*1,994	4	3	0	0	1	206	*650
District 3	30	12	2	3	13	0	189,270	1,284		6	0	0	1	5	365	
District 4	34	16	4	1	13	0	165,705	1,063		11	2	2	0	7	353	
East	35	21	4	0	10	0	157,590	994	866	9	1	0	0	8	286	308
District 7-B	74	41	0	0	33	0	168,203	2,162		18	3	0	0	15	746	
West	129	100	1	2	24	2	671,711	4,609	4,447	17	3	0	0	14	658	699
District 9	86	51	0	2	32	1	222,591	3,584	5,980	16	2	0	1	13	897	*1,682
District 10	33	23	1	6	3	0	118,918	1,077	991	2	0	0	0	2	81	89
Utah	11	5	0	1	5	0	52,316	160	96	5	0	0	0	5	82	56
West Virginia	18	4	0	9	5	0	45,237	501	506	1	0	0	0	1	23	18
Wyoming	10	4	0	0	6	0	58,881	622	632	4	0	0	0	4	214	183
Miscellaneous	0	0	0	0	0	0	0	109	70	0	0	0	0	0	92	62
Total United States	**1147**	611	26	79	409	22	4,816,105	39,963	43,868	**228**	31	4	6	187	8,875	9,695
Total previous week	1086	532	29	78	421	26	4,777,516			249	22	2	2	223		
Cumulative 1957	39,963	20,717	400	2,871	15,138	837	165,361,967			8,875	910	75	308	7,582		
Western Canada	67	45	0	4	17	1	221,326	2,282	2,335	18	3	0	3	12	642	

*Districts: 2 & 3, 1 & 4, 9 & 7-B, formerly combined. †Incl. New York. ‡Incl. Florida and Georgia.

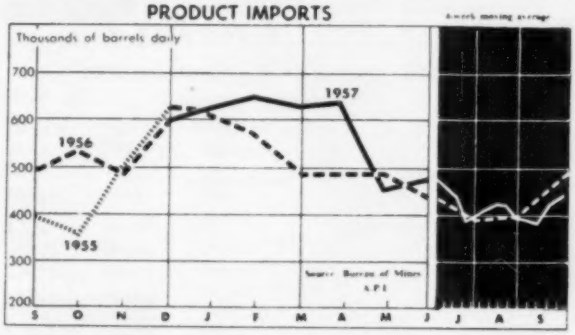
ROTARY RIGS OPERATING IN UNITED STATES



CRUDE IMPORTS



PRODUCT IMPORTS



ACTIVE ROTARY RIGS*

Area—	9-30-57	9-23-57	9-16-57	10-1-56
Alabama	2	4	4	6
Arkansas	27	26	25	16
Arizona	1	1	1	
California	98	97	96	104
Colorado	63	69	65	68
Florida	1	1	1	3
Georgia				
Idaho				
Illinois	63	71	67	93
Indiana	6	8	11	9
Iowa	2	2	2	1
Kansas	151	148	151	172
Kentucky	8	10	12	10
Louisiana	427	450	450	420
North	61	63	62	65
South	276	292	285	355
Offshore	90	95	103	(†)
Maryland	1	1	1	
Michigan	8	11	11	17
Missouri				1
Montana	33	33	30	46
Mississippi	42	40	38	28
Nebraska	36	34	34	27
Nevada				1
New Mexico	148	155	149	128
New York				
North Dakota	40	40	39	25
Ohio				1
Oklahoma	253	266	271	260
Oregon	1	1	1	
Pennsylvania	14	13	13	9
South Dakota	2		2	
Texas	852	887	908	988
Gulf Coast	181	195	203	244
Offshore	2	3	2	(‡)
West	349	357	363	372
North	271	279	280	303
East	49	53	60	69
Tennessee	1	1	1	
Utah	68	64	67	25
Washington	1	1	1	1
West Virginia	2	4	4	2
Wyoming	82	73	79	85
Virginia		1	1	
Total United States	2,433	2,512	2,535	2,546
Western Canada	194	201	208	242
Eastern Canada	3	3	3	
Grand total	2,630	2,716	2,746	2,788

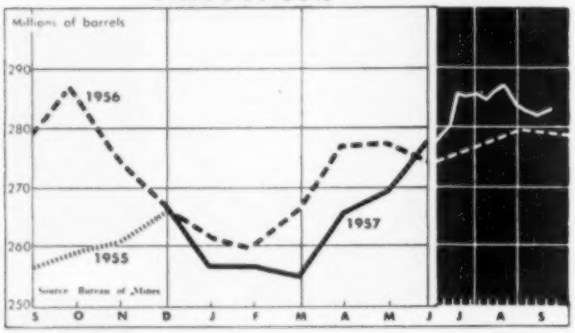
*Hughes Tool Co. †Included with South Louisiana. ‡Included with Texas Gulf Coast.

DAILY AVERAGE PRODUCTION FOR WEEK

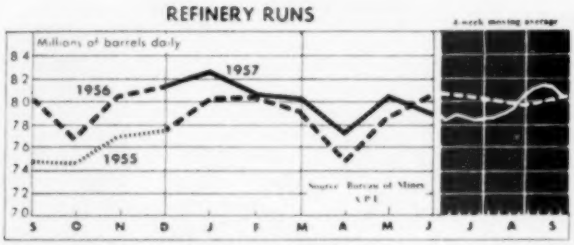
	September 28, 1957			Sept. 21
	Crude oil	Lease condensate	Total	total
Alabama	16,200		16,200	15,500
Arkansas	81,300	300	81,600	81,000
California	928,700		928,700	927,600
Colorado	148,950		148,950	150,100
Eastern	53,200		53,200	52,800
Florida	1,250		1,250	1,250
Illinois	226,600		226,600	229,400
Indiana	33,500		33,500	34,600
Kansas	†338,600		†338,600	†341,500
Kentucky	46,800		46,800	46,300
Louisiana	710,000	70,300	780,300	783,300
North	120,000	2,300	122,300	125,300
South	590,000	68,000	658,000	658,000
Michigan	26,200		26,200	28,500
Mississippi	99,275	4,275	103,550	103,550
Montana	74,700		74,700	74,150
Nebraska	54,800		54,800	55,300
Nevada	100		100	100
New Mexico	249,700	3,700	253,400	253,400
North Dakota	34,650		34,650	36,200
Oklahoma	†553,600		†553,600	†557,700
Texas	2,720,000	54,400	2,774,400	2,774,400
Dist. 1	49,500	500	50,000	50,000
Dist. 2	125,500	8,600	134,100	134,100
Dist. 3	393,000	26,800	419,800	419,800
Dist. 4	207,000	6,100	213,100	213,100
Dist. 5	35,500	275	35,775	35,775
Dist. 6	120,500	5,900	126,400	126,400
East Texas Field	170,500		170,500	170,500
Dist. 7-B	153,000	50	153,050	153,050
Dist. 7-C	142,000	3,675	145,675	145,675
Dist. 8	1,012,000	1,400	1,013,400	1,013,400
Dist. 9	204,500	600	205,100	205,100
Dist. 10	107,000	500	107,500	107,500
Utah	11,550		11,550	11,200
Wyoming	291,550		291,550	292,700
Others	‡200		‡200	‡250
Total U. S.	6,701,425	132,975	6,834,400	6,850,800
Change from previous week, down			16,400	
Canada	†479,600		†479,600	†525,600
Total U. S. production—Jan. 1-Sept. 28			1,972,958,625 bbl.	
Same period last year (crude plus cond.)			*1,944,093,779 bbl.	

*Includes 33,295,555 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

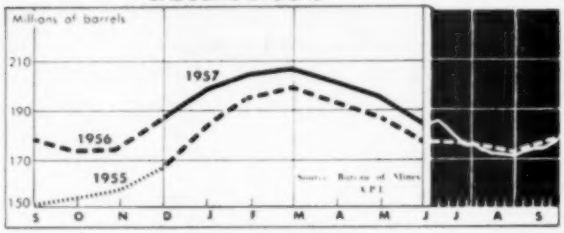
CRUDE-OIL STOCKS



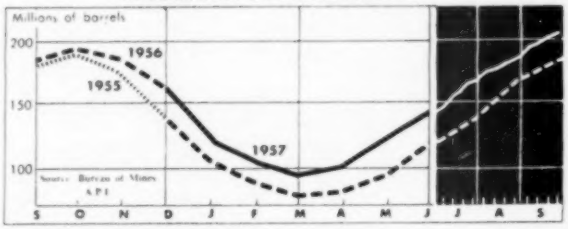
REFINERY RUNS



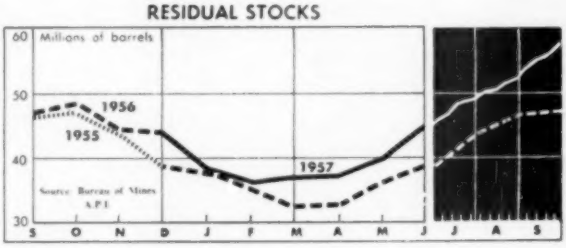
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	9-21-57	9-14-57	9-22-56
Pennsylvania Grade	3,213	3,185	2,539
Other Appalachian	1,759	1,769	2,362
Illinois, Indiana, Michigan	11,663	11,305	11,460
Nebraska and North Dakota	2,835	2,489	2,220
Kansas	10,572	10,146	10,059
Oklahoma	22,072	21,695	25,871
Arkansas	2,673	2,699	2,719
Louisiana	19,462	19,400	17,839
North	3,246	3,300	2,500
South	16,216	16,100	15,339
Mississippi, Ala., and Fla.	2,894	2,696	2,990
New Mexico	10,304	9,824	8,412
Texas	126,995	125,824	121,912
East Texas proper	9,980	10,199	8,729
West Texas	60,508	61,313	58,642
Texas Gulf	24,376	23,933	23,250
Other Texas	32,131	30,379	31,291
Wyoming	15,861	16,817	17,155
Other Rocky Mountain	6,045	6,474	6,137
California	31,042	30,463	27,320
Foreign	†15,775	17,310	15,608
Total	283,165	282,096	274,603

*Bureau of Mines. †Includes 5,383,000 bbl. in California.

A.P.I. REFINERY REPORT, SEPTEMBER 27, 1957

(Thousands of barrels)

										—Bureau of Mines, September 1956—				
	Daily	—Daily average production—				—Stocks‡—				Daily	—Daily average production—			
District—	avg. runs	Gaso.*	Kero.	Dist.	Resid.	Gaso.†	Kero.	Dist.	Resid.	avg. runs	Gaso.*	Kero.	Dist.	Resid.
East Coast	1,163	504.7	.....	297.4	195.3	44,057	15,159	63,639	14,085	1,105	467.3	29.3	306.1	174.8
Appalachian:														
District 1	98	44.1	2.7	20.6	5.6	4,627	606	3,604	562	106	44.7	4.8	25.1	4.3
District 2	108	57.9	6.7	17.7	11.4	2,542	645	1,223	168	98	52.3	3.5	16.8	12.6
Ind., Ill., Ky.	1,407	750.6	60.4	275.1	180.8	29,893	7,194	24,149	5,853	1,451	764.4	70.4	307.2	147.3
Minn., Wis., Dak.	43	13.1	1.4	12.4	7.7	5,607	1,665	8,253	479	91	43.0	5.4	23.8	8.8
Okla., Kans., Mo.	699	400.0	13.3	172.6	29.3	13,882	1,860	14,504	1,070	671	374.5	14.0	165.8	25.9
Inland Texas	267	219.2	4.4	54.3	23.1	6,750	533	2,737	1,985	282	208.4	7.8	53.5	22.3
Texas Gulf Coast	1,925	997.6	110.6	448.8	222.1	23,678	3,794	19,605	8,172	1,944	917.2	116.9	482.8	245.7
La. Gulf Coast	619	396.4	12.9	210.9	51.9	10,965	3,089	8,728	1,702	699	347.4	59.2	197.0	49.7
N. La. and Ark.	98	40.1	8.2	23.3	6.9	4,311	1,004	2,223	195	103	40.1	8.2	23.3	5.4
Rocky Mountain:														
New Mexico	28	14.0	0.9	5.6	3.0	420	13	108	69	24	13.0	0.3	4.8	3.2
Other Rocky Mtn.	288	133.1	3.1	66.1	32.6	5,486	350	3,208	928	269	127.9	5.1	57.9	33.9
West Coast	1,175	490.3	.....	150.6	363.0	25,212	419	17,284	22,448	1,181	502.3	4.2	181.0	328.4
Sept. 27, 1957	7,918	4,061.1	224.6	1,755.4	1,132.7	177,430	36,331	169,265	57,716	8,024	3,902.5	329.1	1,845.1	1,062.3
Sept. 20, 1957	7,830	4,030.3	289.7	1,715.3	1,117.1	174,058	36,190	165,762	56,003	.....	.....	.....	.....	.....
Sept. 28, 1956	7,912	3,870.4	354.9	1,820.6	1,088.9	174,720	33,817	150,367	47,499	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.50-11.75
Premium (98 octane)	14.25-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California (rack):	
Regular (88 octane)	12.9
Premium (96 octane)	14.9
Premium (98 octane)	15.4
Caribbean area (cargoes):	
Regular (87 octane)	10.875
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.0
Breckenridge:	
Grade 26-70	3.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-10.00
Diesel oil (58 d.i. and above)	9.125-9.75
Distillate No. 1	9.125-9.75
Distillate No. 2	8.50-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.75-9.50
Distillate No. 2	8.75-9.50
New York Harbor (barges):	
Kerosine 41-43	10.75
Distillate No. 2	10.25
Diesel fuel, 48-52 d.i.	10.55
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.75-2.00
Gulf Coast (cargoes):	
Bunker C fuel	$2.50-2.75
New York Harbor (barges):	
Bunker C fuel	$2.95
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.0[illegible]
Ville Platte	3.4[illegible]
Texas:	
East Texas	3.2[illegible]
Conroe	3.5[illegible]
Van	3.0[illegible]
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Zanesville Grade	3.04
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.74
Redwater (Alta)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 36.0°-36.9°, Fao	2.00
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.59
Iraq, 36.0°-36.9°, Tripoli, Banias	2.59
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC—30%)	$2.00
Carib.-U.S.N.H., dirty (USMC—55%)	1.22
★ Carib.-Montreal, clean (USMC—35%)	2.63
P.G.-France, dirty (USMC—65%)	3.82

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LEGAL

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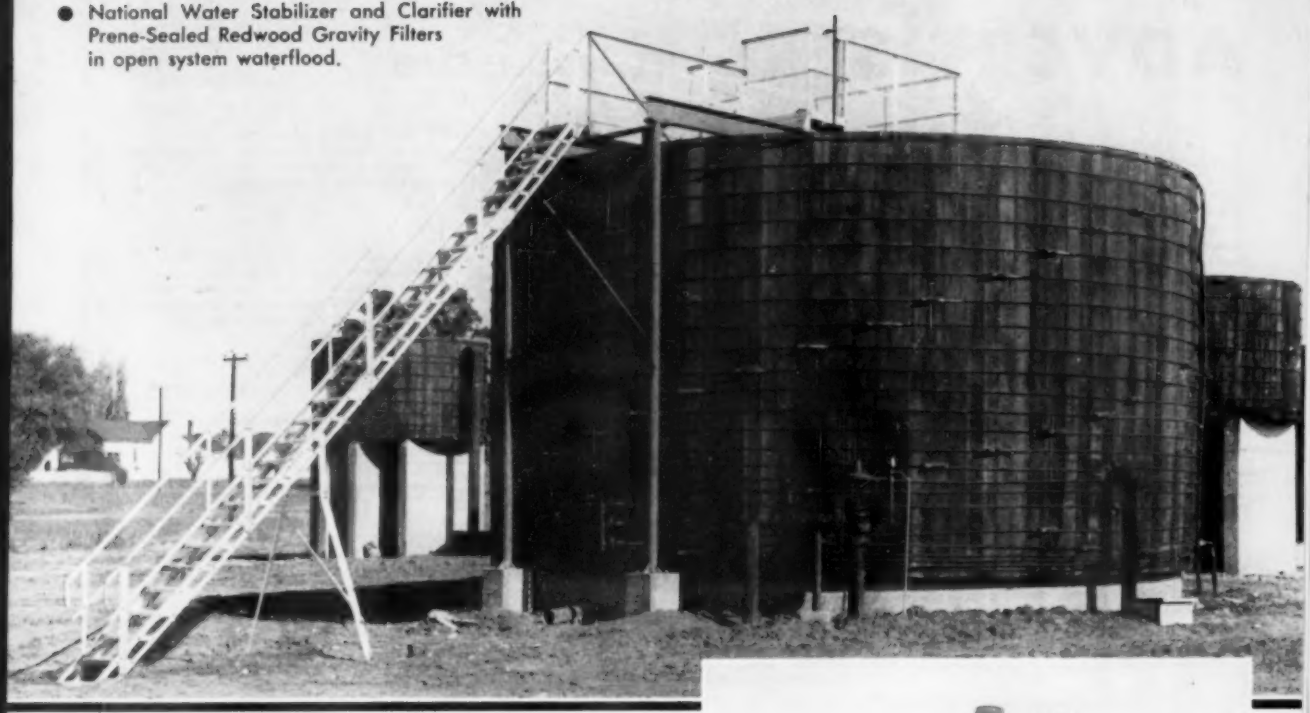

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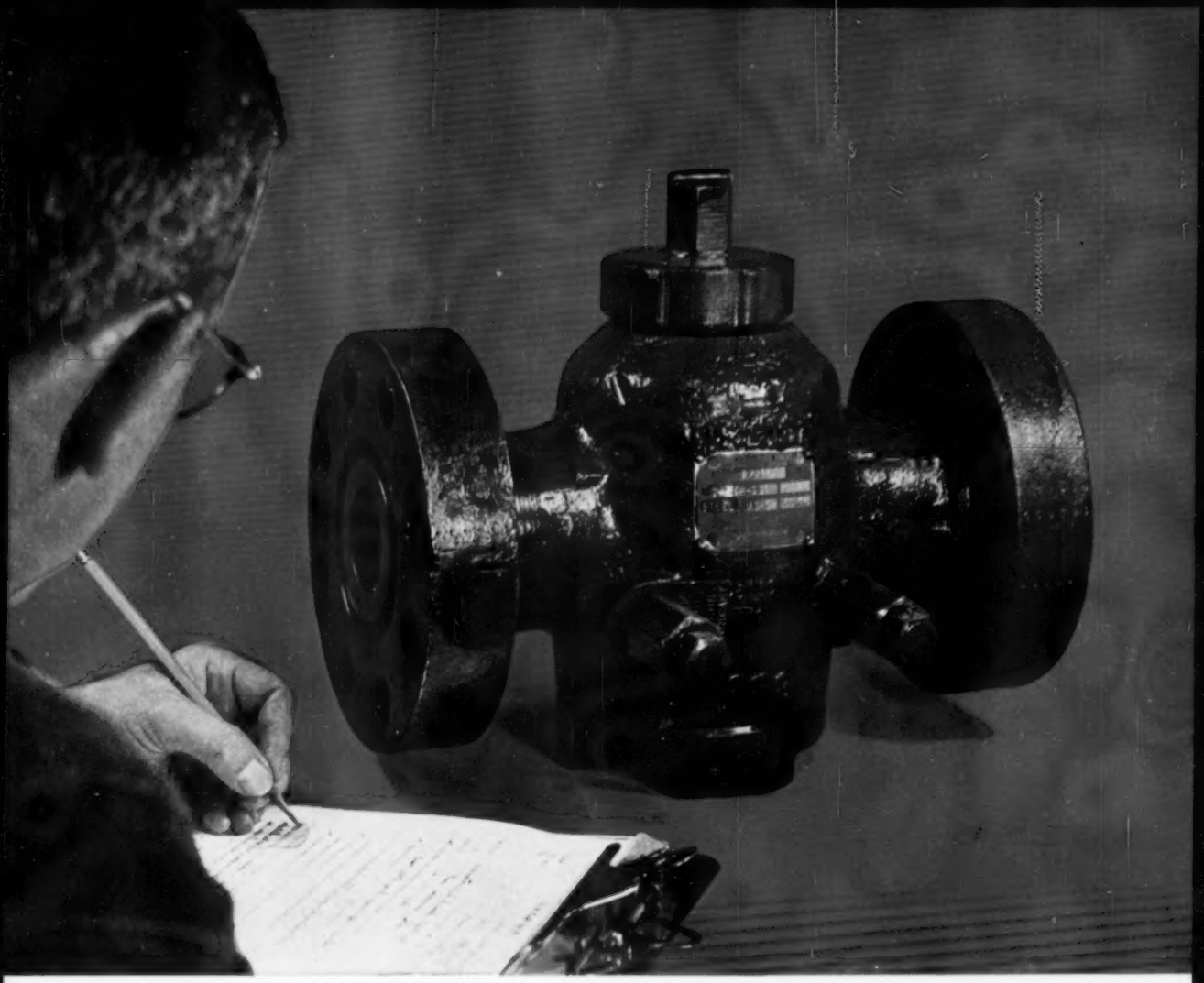

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